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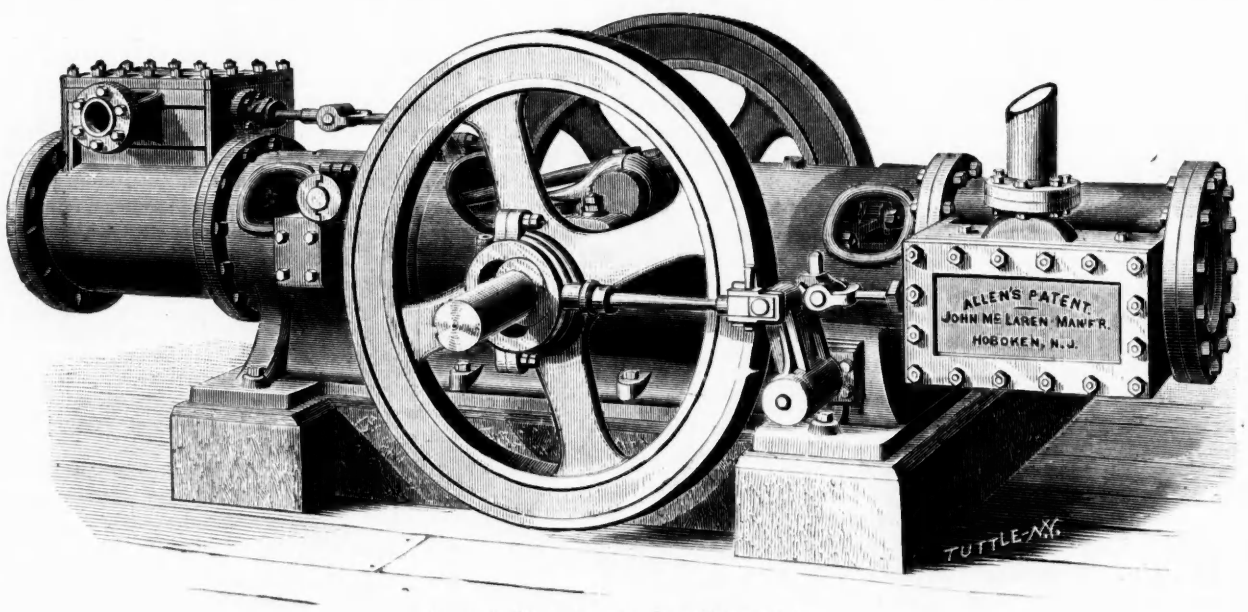
Allen's High-Speed Air Compressor.

John F. Allen, the designer of the well known Allen steam engine, a few years ago originated a pneumatic riveter, which was operated by compressed air. In order to do his work it was necessary to run the compressor at a higher rate of speed than most of the compressors in use, so Mr. Allen designed one which was calculated to give very economical results. During the course of his experiments, he discovered that certain valves upon a compressor would operate well enough at a moderate speed. But when that speed was exceeded, the air was simply compressed in the cylinder, without being delivered into the receiver. This was caused by the momentum of the poppet valves while in motion, and their inertia when at rest, they being operated by the air, an elastic medium, and uncontrolled by any positive motion of the machine itself; and, therefore, at the increased speed, they would not keep time with the rest of the moving parts. After numerous experiments, the principles which were previously embodied in the Allen engine, were adopted, viz., a high speed and heavy reciprocating parts. In this compressor, the motion of the valve is the same at all speeds, it being of the D slide type, and operated by a positive movement, the velocity of the closing, as well as of the opening movement, increases with their frequency, thus a proper speed of piston is attained, with a stroke of only moderate length. The valves are all in equilibrium, and by the application of the positive motion, air may be compressed in direct proportion to the speed of piston. By the employment of heavy reciprocating parts, a large percentage of power is saved, because by them the force is transferred to that point of the stroke where it is most needed, thus relieving the crank and shaft from most of its friction and all heavy strains.



ALLEN'S HIGH SPEED AIR COMPRESSOR.

The diagram on page 2 illustrates how this is accomplished. Let *m*, *n*, *O*, *P*, *Q*, represent the steam diagram, and *m*, *R*, *S*, *Q*, the diagram from the air compressor. It will be observed that the force of the steam at the commencement of the stroke has very little resistance from the air; and at the latter part of the stroke, where the force of the steam is reduced by expansion, the resistance from the compressed air is greatest. When it becomes necessary to equalize these forces by means of the fly-wheel, almost all the force of the steam (which even in moderate-sized cylinders will amount to ten or twelve tons) will be thrown upon the shaft, and the shaft revolved under this load. After this force has been transferred to the fly-wheel (by which it is transferred to the shaft again), by means of the crank it compresses the air in the cylinder. It will be easily understood that in this process a large proportion of the force would be lost, besides creating an excessive wear and tear of the parts. This loss is greatly aggravated when the steam cylinder is connected with one end of the shaft and the air cylinder with the opposite end. But by the employment of heavy reciprocating parts, the force of the steam diagram, *n*, *m*, *X*, will be absorbed in the acceleration of these heavy parts at the commencement of the stroke, and given out at the latter part of the stroke as momentum, *X*, *Q*, *Y*, to compress the air. It is therefore apparent that when the forces are transmitted by the same reciprocating parts the load is not thrown upon the shaft at all, and that the latter will revolve in equilibrium. In the construction of the Allen compressor the aim has been to attain strength and efficiency. The bed is massive and its form well suited to maintain rigidity under the severest tests. The cylinders are attached to the bed in a manner insuring perfect alignment, the outer ends being free to move by expansion. The valves move in equilibrium, but are made simple D slides when required. They may also be made with a variable cut-off. Duplicate valve seats are furnished when required in order to facilitate the changing of proportions, or in case of injury to the seat from cutting they can readily be changed. No water jacket is used around the air cylinder, the cooling being accomplished by means of the oil and water, which is used to fill the cylinder clearance. This liquid circulates itself, and is cooled by passing through a worm surrounded by water. When a water jacket is desired, it is formed by placing a hard steel lining in the cylinder. By the construction of this compressor steam may be cut off at half stroke, as shown by the card on page 2 taken from the steam cylinder; while the other card taken from the air cylinder shows no clearance. The size of the compressor from which these cards were taken was a 12″x 12″, running at a speed of 144 revolutions per minute. The scale of the cards is 26 lbs.

There are over fifty of the Allen compressors in use, which are said to give entire satisfaction. They are made by John McLaren, River Street, Hoboken, N. J.

Care and Management of Steam Boilers.

BY F. B. ALLEN.

(*Extracts from an address to the Polytechnic Society of the American Institute.*)

Many improvements have been devised and applied to steam boilers, the effects of which are to lessen the chances of accident. Much yet remains to be done, and we realize its importance when some appalling explosion occurs, involving loss of human life and great destruction of property.

The sectional safety boilers, so much in favor 10 years ago, have, with some few notable exceptions, proved an expensive failure; probably not 10 percent. of the number put in at that time are in use to-day. Cast iron, principally used in their construction, was one of the earliest materials used in steam-boiler construction; but it had to be abandoned, its great danger of cracking under change of temperature, to which steam boilers are peculiarly exposed; the want of uniformity in its strength owing to defective castings, through honey combing and blow holes; the varying expansion between cast and wrought iron; the use of rubber grummets in making joints; contracted and tortuous passages, through which the steam bubbles must force their way to the steam drum, insufficient arrangements for cleaning out, etc., etc., were some of the many causes that led to their condemnation.

The wrought iron shell boilers (of which there are many kinds) are the ones that give the most satisfaction to-day, taking into consideration their first cost, expenses for maintenance, economy of performance, and durability. The return tubular boiler, so generally used in our large cities where the feed water is comparatively pure, is a superior form of boiler; and when properly built, set, and managed, in my opinion, there is no better boiler.

Too little attention is paid to the location of the steam boiler. After everything else is provided for, the question comes up: Where shall we put the boiler? It is the most foolish thing an owner can do, to put his boiler in some damp, dark cellar, or more frequently sub-cellar, or other out-of-the-way place, where it's sure to be neglected, and special opportunities offered for its rapid corrosion. By all means set your boiler in a dry place outside your building, if possible, and in the light of day. Make a habit of visiting the boiler room frequently; confer with your engineer on matters concerning his department. It will pay. Show an intelligent appreciation of his work; see that your fire room is kept in order and the boiler and fittings bright and clean; on general principles, if the boiler indicates neglect externally, it is far worse internally: and, apart from the great danger to which you may be exposed in using a foul boiler, means dollars, or their equivalent, shovelled into the furnaces, from which no return is made.

There are engineers and engineers—one may be dear at $18 per week, another cheap at $25 per week. This point will be best appreciated by those who are most conversant with the subject. Having spent thousands of dollars in buildings and fitting up a mill, or factory, with modern machinery adapted to your business, is it good management to intrust its care to the cheapest engineer you can obtain?

Instances of this kind are of almost daily occurrence; many result very disastrously. Most of them are such expensive experiments, that they are never repeated by the same party. Within certain well-defined limits the best is the cheapest. Don't let a few dollars prevent your employing the most competent man, one, who knowing his ability and experience, may seem to you to be too high priced. We are often reminded that all things constructed by human hands are imperfect; those imperfections increase with age and use. It would effect an important saving in repairs, with greatly increased efficiency and durability of machinery and tools, if regular days—if possible twice in each year; the time regulated by the dull season of the particular business in which you are engaged; when the mill should be stopped and needful repairs, alterations and improvements be made.

The boilers should be thoroughly swept and cleaned out, painted and oiled, when exposed to corrosion, defective joints remade, leaky valves ground in, etc. Too much of this work is reserved for Sunday, and it is often very indifferently done. That day, being one of rest, all are anxious to enjoy it as much as possible; the temptation to hurry through and get home is not unnatural. As for the engineers and firemen, they are usually employed by the week or month, and no extra pay allowed for Sunday work, it is not to be expected they will tarry over long.

Regularity in firing and cleaning the fires is not attended to by engineers as they should be; keeping a clean even fire, not ex-

ceeding about eight inches in depth, and a bright ash pit show the attentive man. Filling up the furnaces with a large quantity of fresh coal in hills and hollows, that he may have long rests between, is the plan often pursued. It is a wasteful and expensive one for the man who furnishes the fuel. Feeding the boiler at long intervals, by allowing the water to fall to the level of the lower gauge cock, and then pumping it up to the upper gauge again, is a dangerous plan, injurious to the boiler, causes great variation in the work of the engine, and is wasteful and objectionable in many other ways. The better plan is to have your pump so regulated that the water is kept within the boiler at a uniform level. I have run day after day with a string tied around my water-gauge glass, as a mark to guide the fireman, from which the water level did not vary one quarter of an inch. It's my judgment, after some years of practical experience in such matters, and attentively noting the manner in which firing and feeding the boilers is usually performed, that upon at least 50 per cent. of the boilers in use a saving of 10 per cent. in fuel could be effected and increased power obtained—not by the addition of any patent contrivance or attachments to the furnace, which I do not disparage however, but simply by attention to details that ought to be known, and, what is of more importance, practiced by all engineers.

It is assumed here the engineer's duty is principally the care of the boiler, engine and machinery. This is not always the case, if it is expected he can run an elevator, load boxes and packages on four different floors for as many tenants, deliver these goods to the truckman on the sidewalk, and help load when required. This, with the care of a 40-horse power boiler, devolved upon one of our engineers employed at a city store, and fault was found when this much-abused man neglected his boiler.

Most externally-fired boilers are set too close to the grate. In one that recently came under my notice this distance was thirteen inches, with an 8-inch fire upon the grate. Within so contracted a space, it seems to me much of the fuel is burned at a loss. One large company, who use about fifty boilers, have for several years past set all their boilers at thirty to forty-two inches above the grate, and claim to have obtained much better results than under the old plan of about sixteen inches.

An improvement is very much needed in the present plan of feeding boilers through the front head. The ill effect is not so great when the feed first passes through a heater; but all boilers are not equipped with heaters, and the effect of cold feed upon the highly heated fire sheets, and the sudden contraction that must ensue, cannot but be highly injurious.

Sticking of safety valves is a very common occurrence; it is most liable to occur in those boilers running at nearly an uniform pressure, with a pressure damper regulator, where weeks, perhaps months, may elapse without the steam pressure increasing sufficiently to lift the valve, which is usually set at ten to fifteen pounds above the working pressure. Under such circumstances they are sure to stick. Safety valves should be "eased off their seats" every day. This can be done with little trouble at a very slight expense, by means of a pulley line from the valve lever to some convenient place in the engine or fire room.

Blowing out externally-fired boilers set in brick work, as usually done under pressure immediately after the fires are hauled, and while the brick work is yet heated to a high degree, is one of those pernicious customs practiced by ignorant men, that has strained the seams inducing seam rips, crystallized the fire sheets, loosened the tubes, and done greater injury than years of use, withal defeating the object for which it is done. It is a fact that the sediment remaining is acted upon by the hot masonry and baked like pottery, so that edged tools are required to remove it. In tubular boilers this can only be done by removing the tubes.

I have found the following an excellent plan in preparing externally-fired boilers for a thorough cleaning: At the close of the day's work either haul the fires or let them die out; when the pressure has fallen to about 5 lbs. raise the safety valve and let off the remainder, block the safety valve wide open, and do not allow it to be closed again until it blows freely, when the boiler is next fired upon. After the brick setting is cooled sufficiently, and that is usually several hours after fires are hauled, open the bottom, blow off and let out the remaining water. Remove man and hand hole plates, and it will be found that the sediment on the tubes or shell is soft and "sludgy," and can readily be washed off with a hose and removed through the hand-hole plates. This plan should be pursued at least once in three months; in some localities it will be better to do it every thirty days.

Do not use animal fat or cheap tallow upon your engine, particularly not in the cylinder oil cup. It may appear cheaper to use those things than well-known lubricants that are more expensive in first cost. Much damage has been done to the valve seats, and parts of the boilers by these fatty acids, which are very destructive to the parts attacked by their rapid corrosive action. Open heaters that return to the boiler oils and grease carried over by the exhaust steam, uniting with sediment within the boiler and lodging upon the fire sheets, or accumulating in the narrow passages between the shell and tubes, preventing the contact of water. Over heating occurs, with dangerous bulges of the sheet, and sometimes rupture, that requires expensive repairs.

The oldest railroad engineer in the United States is George Lay, of Howard, Indiana. He is seventy-six years old, and ran the first locomotive on the Baltimore and Ohio road in 1832. The Brotherhood of Engineers recognize him as their professional dad.

Oshkosh, Wis., is moving for a system of water works. Good for Oshkosh!

Pumping Machinery.

No. 4.

By Chas. A. Hague.

In continuing our subject we have, for the time being, stepped from the field of hydraulic to that of steam engineering; and in fact to the most important one of the two; for we have to deal not only with the economical expenditure of heat, but quite as much with the ways and means of producing, preserving, and conveying it to the place where it is to do its work. The direct object in view, in this particular branch of the general operation, is to consume the least value of fuel on the grates, and let the least number of heat units escape down the waste pipe from the hot well, and to do these things while the pump is elevating the greatest possible quantity of water.

When a man has accepted any certain thing as fact, it is a law of his nature to endeavor to strain everything of similar nature to it, and to be astonished if the second thing does not strain without breaking. For years it was reasoned that steam, like air and similar gases, was a very bad radiator and absorber of heat, and every experiment in cylinder operation that argued to the contrary was set aside as doubtful, or was most thoroughly gone over and examined to find the "error." But about ten years ago, Prof. Tyndall, after a series of careful and thorough experiments, gave to the world the fact that the vapor of water would absorb and radiate heat, several thousand times more rapidly than dry air would do so. And yet, for years men had known that steam would rush into a condenser and give up its heat so nearly *instantly*, that a sensitive vacuum gauge in full communication with the condenser would give but slight evidence of the transmission of hundreds of heat units through the chamber.

Before reaching a conclusion in regard to the expansion of steam, the engineer is confined to several important questions, and these questions require different answers under different conditions. An investigation to determine the number of volumes to which steam can be profitably expanded, gives rise to sub-investigations to determine the *quality of the steam;* the nature of the valve gear, proportions of steam ports, and other particulars concerning the construction of the intended engine claim a share of attention. The items of piston speed, rate of reciprocation, weight of the moving parts, etc., etc., enter into the consideration.

The conversion of heat into work during expansion is accompanied by some very curious and interesting incidents, and, like all good things, reacts in a disadvantageous manner when carried too far. The detraction does not come from any cessation of the primary benefit for which expansion is instituted, but from the increase in the power of the evil genius, "condensation," with which the operation is associated, even in its lowest grades. But the two are inseparable, unless certain precautions are taken before expansion begins. The very thing from which the benefit is derived is the root of the evil referred to, viz., the loss sustained by the expanding steam, of the heat that is converted into work. The mean temperature of the cylinder under ordinary conditions is never up to that of the initial steam, and the higher the ratio of expansion to do a certain value of work (and, consequently, the higher the initial pressure and temperature, and also the shorter the cut-off), the lower the temperature of the cylinder is in proportion.

The obvious reason in this fall in temperature, incidental to the shortening of the cut-off, is, that the expansion curve falls from the point of cut-off nearer vertical at short than at long cuts, and there is proportionately very much more surface exposed to a comparatively "cooler" body of steam in the high than in the low grades. For expansion of ten volumes, the latter half of the curve does not depart very much from a parallel to the atmospheric line, while for four volumes a totally different appearance presents itself, showing that during the former (ten) the cylinder was exposed to a much lower temperature, and for a longer time, than during the latter.

Hence the economy of expansion, and, therefore, the extent to which it is desirable to carry it, depend chiefly upon the success with which the loss of the heat converted is made good. The abstraction of heat, re-evaporation of water set free, and subsequent condensation of initial steam during one cycle is comparatively insignificant, and if each revolution made good its own losses no serious harm would follow. But the quantity of moisture accumulates until there is insufficient time during one stroke to evaporate it all. At very short cut-offs the condensation, at the early part of the stroke, is sometimes indicated after the induction valve has closed.

To prevent this cylinder condensation, the most expeditious and perhaps the only methods, are, to either provide means for supplying the cylinder with the heat it loses

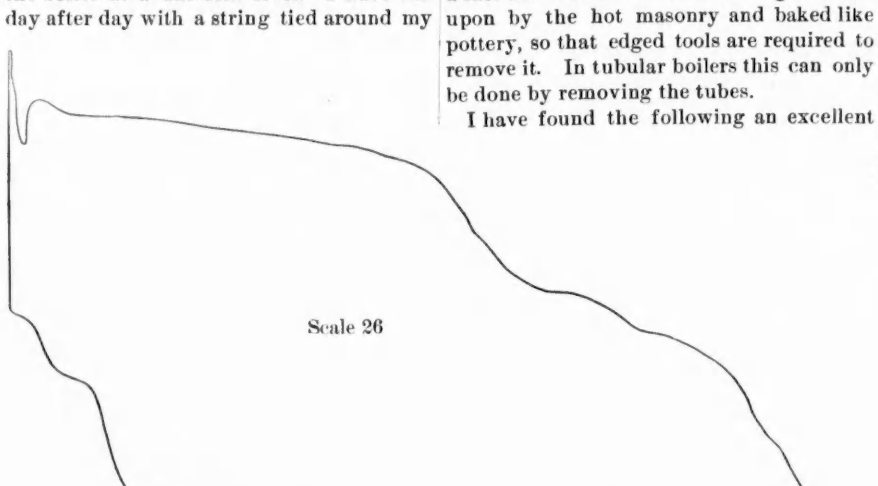


Fig. 1.
Steam Card.

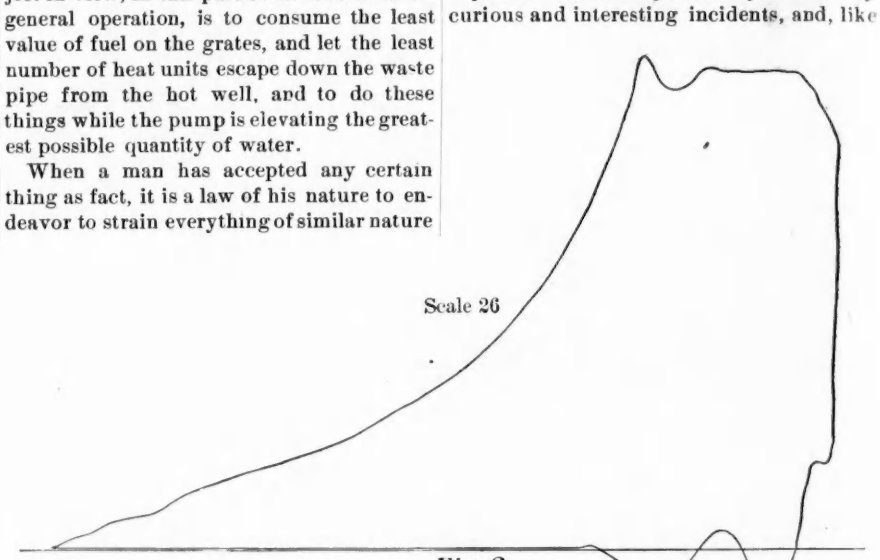
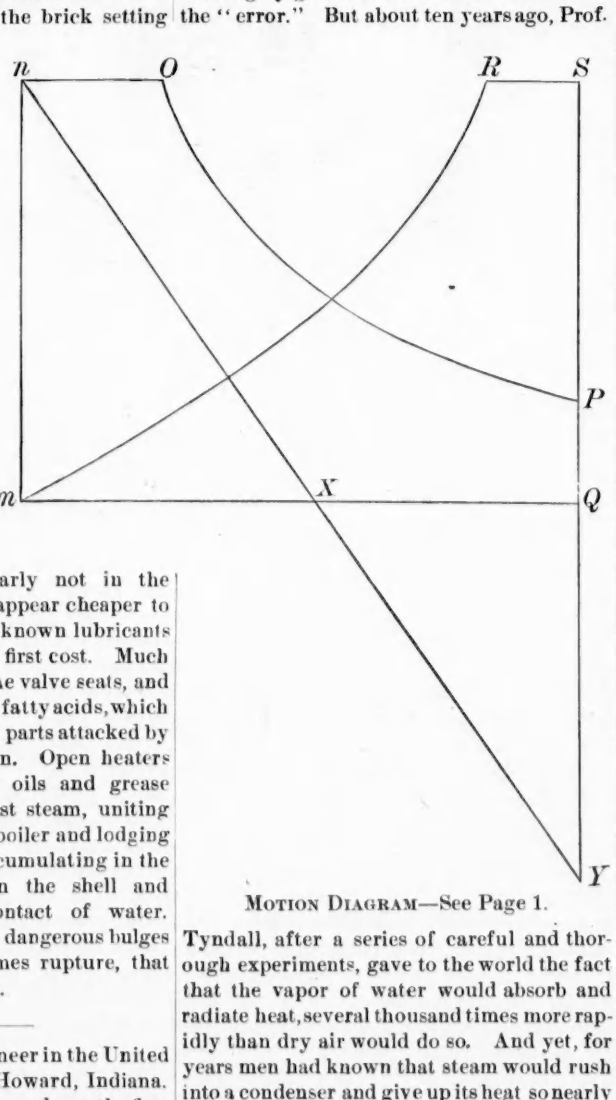


Fig. 2.
Air Card.



Motion Diagram—See Page 1.

during the re-evaporation after cut-off (and so keep the iron up to initial temperature), or to furnish the initial steam itself with sufficient extra heat above its saturated temperature to meet the demands made by the cooled cylinder.

Both of the agents pointed out are often used together, and the application is known in technical language as steam jacketing and using super-heated steam.

The importance of super-heated steam has been long known, but the difficulties surrounding the practice of conveying the heat to the steam, and at the same time controlling the degree of extra temperature, have prevented a very general adoption of the system; but devices are now coming into use aiming to satisfactorily answer all demands. Super-heating is now at about the same stage of progress that automatic engines were twenty years ago; and there is very little doubt of its final success with the steam-using public, when its manipulation is made sufficiently practicable to ensure the benefit promised by its advocates. The super-heating apparatus must be of a character that can be easily understood and managed by the class of help that it pays to employ, as attendants for engines and boilers.

Developments are being made which indicate the necessity of the degree of superheat bearing a specific relation to the grade of expansion, and these developments plainly tell us why the practice of superheating has been unsuccessful by not acquiring a sufficiently high temperature, and hence of not much benefit in some cases; and also why, in other cases, it has failed by indulgence to excess, and thereby burned out the packing and injured the cylinder and valves.

It would seem that the degree of superheat must be as closely looked after as the pressure of steam in the boiler; and its relation to the grade of expansion suggests the idea of regulating the super-heater automatically, to correspond to the automatic control of the cut-off.

As has been previously intimated, steam economy exclusively is not the only desideratum to be looked for in steam engines. The extent to which it is carried must depend upon the relative expense incurred in effecting the expansion, and also upon the means which must be employed in utilizing it under the conditions which accompany the undertaking in hand.

Assuming that we can manage to expand the steam and avoid loss of heat to the utmost extent compatible with the laws of radiation, absorption, etc., and the use of iron cylinders, one of the first obstacles to be encountered is the fact that the energy expended by the steam is very far from being uniform. At the beginning of the stroke the impulse is greatly in excess of all demands, while during the latter part of the stroke the pressure on the piston falls far short of that required to drive the load. Hence, if we *must* use expansion, a suitable *reservoir* must be furnished to receive this excess of energy, and be so related to the general mechanism that the effect will be uniform throughout the stroke. This reservoir may consist either of the ponderous moving parts of the engine, such as the balance wheel, cross head, connecting rod, etc., etc.—the inertia of these parts absorbing the surplus energy during the early part of the stroke, and giving it out again gradually as the pressure falls during the latter portion—or, by the use of compound engines, the pressure may be distributed by the use of a receiver of some magnitude between the cylinders, working steam in conjunction with each other, in which case the inertia of moving parts is of little or no importance in the matter of distribution.

Lubricating Gears.

Where a mill is driven by mortice gearing, it has been recommended to use a mixture of pulverized chalk and linseed oil, for lubricating purposes. It is said that this mixture is much better for wooden cogs than oil, tallow or flour. The chalk for this mixture should first be pulverized and then sifted with a fine sieve.—*American Miller.*

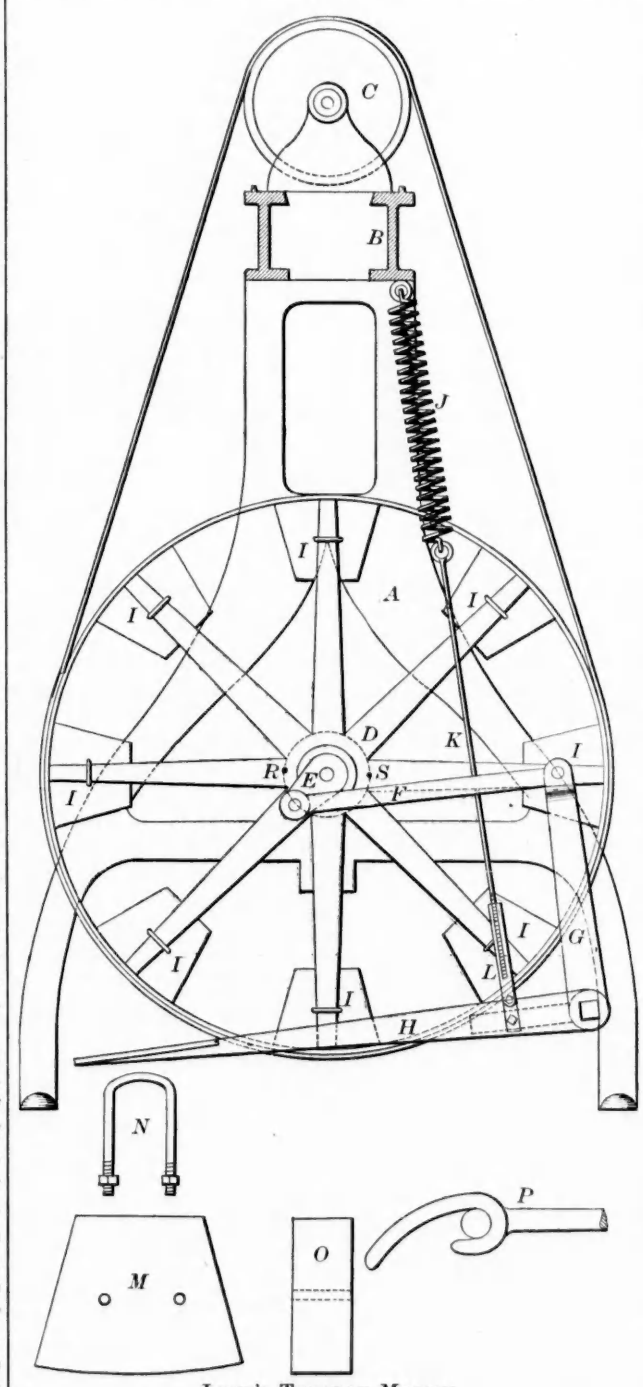
Shop Kinks.

No. 8.

TREADLE MOTION FOR FOOT LATHES.

By L. F. Lyne.

During the past few years there has been a constantly-increasing demand for foot lathes for the use of machinists and amateurs; consequently the inventors and manufacturers have put forth their efforts in their endeavors to produce a lathe which shall combine the best advantages and capacity for producing work. But, in their eagerness to supply the market, they seem, in many cases, to have overlooked the practical importance of having a good reliable treadle motion, or a suitable device for transmitting power from the foot to the pulley. I recently purchased a foot lathe which was made by a leading manufacturer. The workmanship upon this lathe was excellent, and the general design was above criticism. But it was utterly impossible to run a light-finishing cut upon a particular piece of work, neither was it possible to take a respectable rough cut on account of the unsteady motion of the lathe. This was owing to the fact that a weight of twenty-five or thirty pounds had been attached to one side of the large pulley, to help the crank through that part of the stroke where the foot could exert no power.



Lyne's Treadle Motion.

Referring to the accompanying engraving, it will readily be seen that during the forward stroke of the crank, from *S* to *R*, it is propelled by power transmitted from the foot, but during the return stroke, from *R* to *S*, it is driven only by the momentum previously given to the parts in motion.

While an apprentice I was taught that all rotating parts of machinery should be balanced accurately, in proportion to the velocity with which they were required to move, and I have always endeavored to carry out this early lesson in my experience.

In the lathe referred to, the large pulley had been purposely thrown out of balance by the large weight, resulting in a very unsteady motion.

Another serious defect in this lathe was the connection between the pitman and crank pin, shown at *P*, in the engraving. In running at a high speed, if the foot be taken off the treadle, (the weight of the same being insufficient to keep the end of the pitman in contact with the crank pin, in consequence of the pitman being open at the end) the pitman is frequently thrown out of gear with the crank, or causes a very disagreeable and destructive hammering of the pitman upon the crank pin. I succeeded in overcoming the foregoing difficulties by the application of a motion which will be described by the aid of the illustration.

The bed of the lathe is represented by *B*, supported by the legs *A*. These legs also support a square shaft to which is attached the treadle *H*, and the arm *G*. By means of this arm power is transmitted from the treadle through the pitman *F*, to the crank *E*. To put the necessary energy in to the large wheel *D*, in order to produce a steady motion of the pulley *C*, I made some simple cast-iron balance weights *M O*, which were attached to each spoke of the large pulley, as shown at *I*, being strongly secured by a yoke *N*, made of $\frac{1}{4}''$ round iron. I then made a stout spring *J*, of $\frac{3}{16}''$ brass wire (which will beat steel every time) under the back of the lathe bed. An arm of 6″ in length was attached to the treadle shaft, and having a slide upon it, or when desired, a row of holes will answer the purpose. I like the slide best as it facilitates a fine adjustment. A long jaw *L*, was made of $1'' \times \frac{1}{4}''$ flat iron, having a thread cut as shown to fit a $\frac{1}{4}''$ rod attached to the end of spring. By means of this screw the tension upon the spring can be easily adjusted. The operation of this device is as follows: Power being applied by the foot upon the treadle the crank is propelled from *S* to *R*, and after passing the center the tension upon the spring is exerted upon the crank which propels it towards *S*.

In turning heavy work the slide upon the small arm should be moved towards *H*, thereby increasing the action of the spring, while for light work it should be moved in towards the treadle shaft.

By following these directions success is certain. The weight of the balance weights should be proportioned according to the number of spokes in the pulley and the inertia required, always keeping the pulley accurately balanced to insure a steady motion. This motion is new to me and is the best I have ever used, as the pulley can be run so slow that the crank will just pass the centers.

I take pleasure in publishing this "Kink" for the benefit of the craft, and if only one of the manufacturers of foot lathes will adopt the same, I shall feel amply repaid for my efforts. I am not aware of any patent upon this device.

Drew the Wrong Lever.

This is what the pointsman said
With both hands at his throbbing head:
"I drew the wrong lever standing here
And the danger signals stood at clear;
"But before I could draw it back again
On came the fast express, and then—
"Then came a roar and a crash that shook
This cabin floor, but I could not look
"At the wreck, for I knew the dead would peer
With strange dull eyes at their murderer here."
"Drew the wrong lever? Yes, I say!
Go, tell my wife, and—take me away!"
That was what the pointsman said
With both hands at his throbbing head.
O ye of this nineteenth century time,
Who hold low dividends as a crime,
Listen! So long as a twelve hours' strain
Rests like a load of lead on the brain,
With its ringing of bells and rolling of wheels,
Drawing of levers until one feels
The hands grow numb with a nerveless touch,
And the handles shake and slip in the clutch,
So long will ye have pointsmen to say—
"Drew the wrong lever! take me away!"

The Railway Age.

The last issue of *The Locomotive*, published by the Hartford Steam Boiler Insurance Company, gives a summary of their work of inspection for the year 1880, from which we take the following:

The whole number of defects was 21,033, of which 5,444 were considered and reported as dangerous. Thus it appears that about one in four of all discovered is the average of dangerous defects for the year. These were of such a character as would not brook neglect, and they were promptly repaired, so that the policy of insurance covering the several boilers in which they were found might continue in force. The mutual advantage to be derived from prompt attention to positively dangerous defects, as well as those of a doubtful and economic nature, has often been discussed in this column, and the readiness with which boiler owners act upon the company's suggestions and recommendations is a gratifying indication of the growing popularity of this method of securing immunity from boiler mishaps. It is obvious, without argument or illustration, that timely repairs to five and one-half thousand of dangerous conditions has saved many human lives and much valuable property from destruction. Although it is by no means claimed that each dangerous defect would have resulted in destructive explosion within any given period of time, still there is no doubt that a large number of them would have furnished business for professional expert witnesses and coroners if they had been left to themselves, or to the management of stupid attendants, who are often hired at a rate of pay that indicates incompetence, if nothing more. The advantage that competent boiler inspectors have over even the most competent local engineer in judging of the condition as to safety of any given steam boiler is something like that of the practicing physician over the amateur or even the professional chemist, who does not practice, in judging of the probable termination of a diseased condition of the human body. The inspector, like the doctor of medicine, depends largely upon post-mortem examinations, and their respective abilities may be nearly measured by the interest they take in the study of obscure defects in the defunct subject. The details of the defects for the year 1880 are as follows:

Furnaces defective, 1,105—284 dangerous. Fractured plates, 2,075—1,168 dangerous. Burned plates, 1,165—369 dangerous. Blistered plates, 3,444—421 dangerous. Cases of sediment and deposit, 2,759—628 dangerous. Incrustation and scale, 3,891—533 dangerous. External corrosion, 1,255—440 dangerous. Internal corrosion, 933—300 dangerous. Internal grooving, 234—109 dangerous. Water-gauges defectice, 525—117 dangerous. Blow-outs defective, 208—93 dangerous. Safety-valves overloaded, 258—139 dangerous. Pressure-gauges defective, 1,685—380 dangerous. Boilers without gauges, 771—21 dangerous. Cases of deficiency of water, 119—65 dangerous. Defective bracing and staying, 403—229 dangerous. Boilers condemned, 377.

When a boy walks with a girl as though he were afraid some one would see him, the girl is his sister. If he walks so close to her as to crowd her against the fence, she is the sister of some one else.

Melvin's Steam Generator.

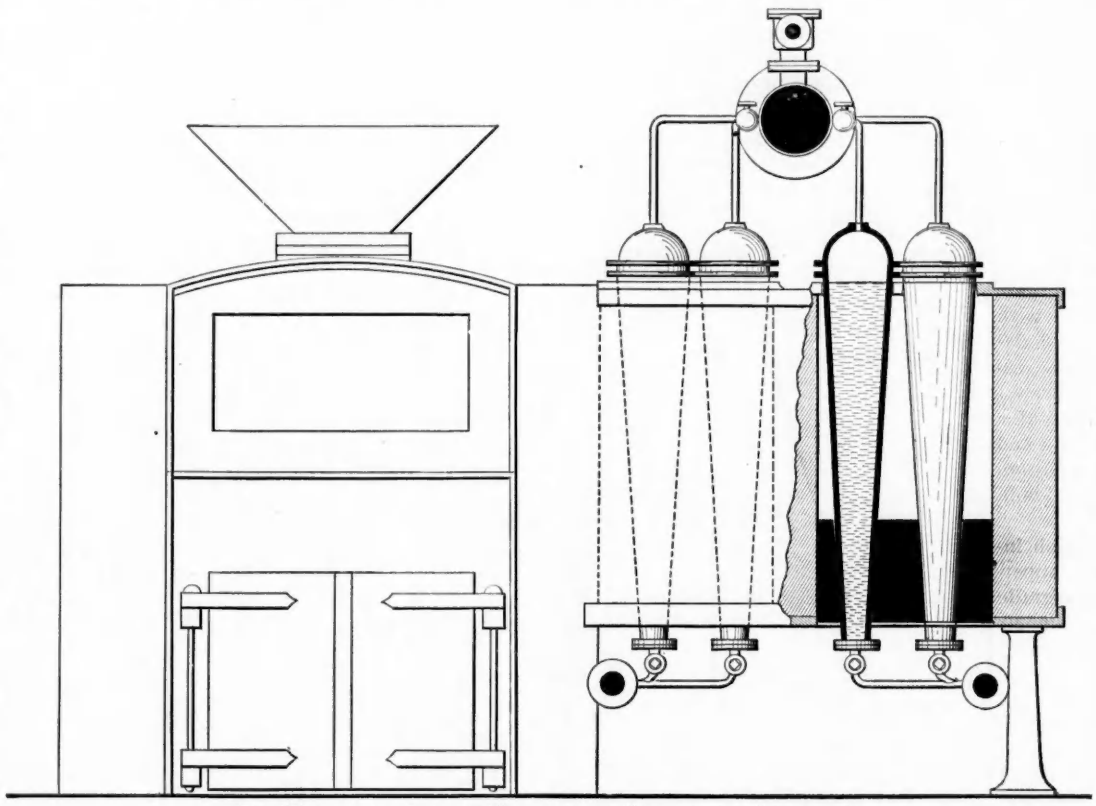
Conical tubes have been in use, for quite a number of years, for the purpose of generating steam; but mainly as an adjunct to a shell boiler, as in the well-known "Galloway Boiler."

The peculiar advantage of cone tubes for the evaporation of water, lies in the liberation of globules of steam from the sides; as soon as formed they ascend vertically and consequently leave the side of the tube free to transmit heat to the water during their ascent; while in a parallel tube they adhere to the side during the whole of their ascent, and consequently decrease the efficiency of the heating surface to at least half that of a horizontal or inclined surface of equal area.

This has been recognized and taken advantage of in making the sides of some firebox boilers angled, also in locomotive fire boxes; and quite a number of patents have been taken out for boilers with conical heating surfaces.

Any student who has held a test tube with his hand over a spirit lamp is well aware of how the liquid rises in the tube when it begins to boil, and many of them can testify to this by burns and scalds on the hand and wrist. If a tapered glass tube is used, and the heat allowed to impinge on the sides and descend, the experimenter will be surprised to see the calm, steady manner in which steam is disengaged from the angled sides of the tube, quite unlike the tumultuous and almost explosive way in which it is liberated in an ordinary test tube.

The result of this when applied practically is to ensure drier steam, and also increased efficiency of heating surface.



End View and Part of Transverse Section of Generator.

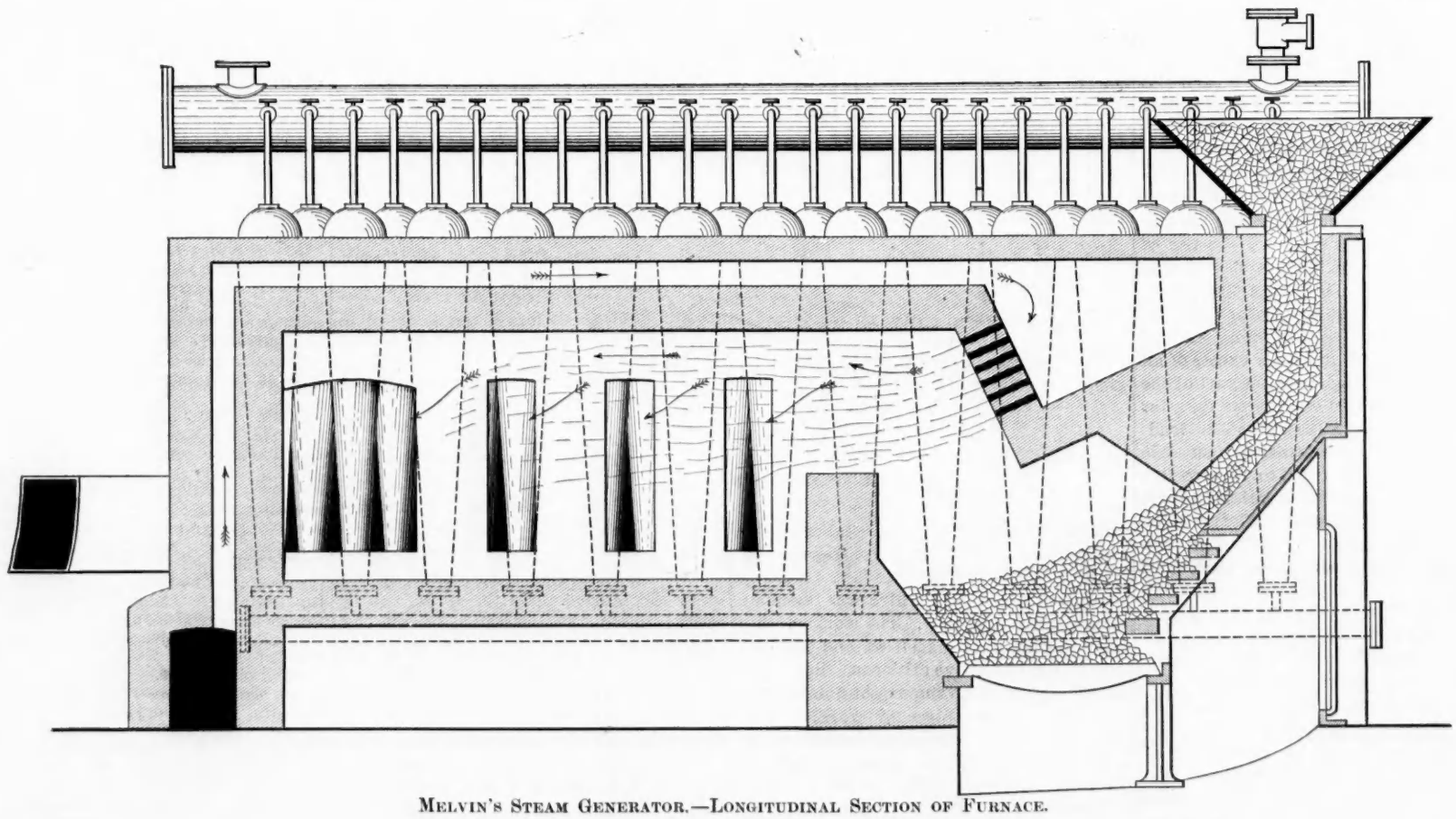
The accompanying illustrations represent a boiler constructed on this principle. It is constructed entirely of inverted conical tubes, hung from plates supported on brick walls, these walls forming a heating chamber or oven, through which the hot gases from the furnace circulate on their way to the chimney. The lower ends of the tubes project entirely through this chamber, which is closed on the under side with plates similarly to the top, but the plates are much lighter, as they have no load to carry. The feed pipes are attached to the lower ends of the tubes in a similar manner to the steam pipes, which are connected to the dome-shaped caps on the upper ends of the tubes.

The whole arrangement is simple, each cone tube forming an independent steam boiler, with separate feed and steam pipes and steam space; and these connections are so arranged that no tube is rigidly fixed, but may expand or contract without affecting its neighbors or in any way injuring itself, the feed and steam pipes fulfilling the function of expansion joints. Any one of the tubes can be removed with steam on without disturbing any of the others, by simply unloosing four bolts and lifting it out. Cocks are provided both on feed and steam pipes, so that any tube may be isolated from the others; and they are so arranged that a tube can not be closed without allowing the pressure to escape; that is, the tube must either be in connection with the steam drum, or open to the atmosphere.

It will be observed that no joints of any kind are exposed to the heat from the furnace, all the joints being outside of the heating chamber, and they can be tightened up at any time when steam is on the boiler.

The sectional elevation is through the furnace, which has been constructed for the better utilization of small coal, and to supplant skilled firing.

The coals are fed from the hopper above, down the inclined grate, and the fire is purposely kept thick. The products of combustion are made to traverse the large combustion chamber before entering the heating chamber of the boiler through the apertures shown in the side wall.



Melvin's Steam Generator.—Longitudinal Section of Furnace.

The combustion in this furnace is perfect, and there is no loss through escaping carbonic oxide gas, as in hand firing with small coal.

The action is as follows: Air entering the grate burns the coal, first, to carbonic acid, which is represented by CO_2. The molecule of this gas, arising through the thick mass of incandescent carbon above, takes up another atom of carbon and becomes two molecules of carbonic oxide. Thus:

$$CO_2+C=CO+CO \text{ — or } 2\ (CO).$$

This is what actually takes place in an ordinary boiler furnace when too thick a fire is carried for the size of anthracite coal used, and, ordinarily, the two molecules of carbonic oxide escape to waste, carrying with them, in a latent state, all the heat which would have been generated by the complete combustion of their two atoms of carbon. Air is sometimes admitted above the fire to effect the combustion of the carbonic oxide; still a great part of it escapes unburned unless the air is heated to a very high temperature.

On the escape of the products of combustion into the combustion chamber, a supply of air is admitted through the perforated firebrick archway above the fire, and this air, mixing with these gases at a very high temperature, effects their complete combustion. The refrigerating effect of a boiler shell in cooling the gases as they escape from a fire is not here felt, and the consequence is that the combustion chamber rises to a white heat, and combustion goes on steadily and regularly. The gases being so intimately mixed at this high temperature, less air is required, and the residual gases are less in quantity, thereby insuring a higher temperature in the flues, and fewer units of heat discharged up the chimney.

In a four-days' run with the above boiler, 14,000 lbs. of coal were burned and 2,085 cubic feet of water evaporated from a temperature of 100° Fahr. This gives $\frac{14000}{2085}=$ 6.72 lbs. of coal per cubic foot of water evaporated. A cubic foot of water weighs 62.3 lbs, at 100°; therefore, $\frac{62.39}{6.72}=.27$ lbs.

of water evaporated from 1 lb. of coal. The coal was a small pea anthracite and contained 15 per cent. of ashes. Allowing for this, we have 10.9 lbs. of water evaporated per pound of combustible. Reducing to the usual standard, namely, water evaporated "from and at 212° Fahr., we have 1,080 units of heat in steam from water at 100° Fahr., at 80 lbs. per square inch pressure, and 966 units as the latent heat of evap-

oration at 212° Fahr.; then, $\frac{1080}{966} \times 9.27 =$ 10.36 lbs. of water; or, taking the actual combustible, 12.18 lbs. of water evaporated per pound of combustible.

This boiler was patented in March, 1868, and reissued August, 1876. The old firm of James Watt & Co., of Soho, England, are now making cone tube boilers exactly similar to the above, and, from the fact that the use of the long-known and well-tried Galloway tubes is still increasing, we may expect to see this principle used to a much greater extent in this country than at present.

The boiler illustrated herewith is the invention of D. N. Melvin, of Linoleumville, Staten Island, N. Y., where a boiler of this style has been in constant use during the past year.

LETTERS FROM PRACTICAL MEN.

An Apprenticeship Plan.

Editor American Machinist:

The apprenticeship question has been started once again. Let it be freely discussed in your columns. It demands the attention of workingmen, and, if properly carried out, will provide us with the skilled labor so much in demand at the present time. In many large shops our skilled workmen have come to us from across the waters, and unless some plans are made for the future, we shall have to import our mechanics from the workshops of Europe, while our American youths are turning into street loafers, or are eking out an existence behind some desk or counter, working for $40 per month.

We have always regarded boys with a great deal of interest, and ever been ready to help them, to give the instructions they so much need, have procured places for two or three of them in small shops as apprentices to learn the machine trade. We gave one bright, smart young fellow his first lessons in mechanical drawing, and to-day he is a steady persevering young man; educated above the common run of boys in shops, and will make a good workman, and unless we have mistaken humanity, will remain a warm friend.

Your editorial strikes right to the point: yet we would like a hint at one or two things in considering this question. The home training of our American boys conflicts with the rules and training of a machine shop. We have been vexed beyond expression, when some bright, smart boy has been buzzing around the shop; and we engaged him in some conversation—the subject being broached about coming into the shop as an apprentice. He has come back to the shop in a day or two, and said his mother and sisters did not like to have him come into the shop to work, because it was such dirty, greasy work. We have pressed him as to his idea of choosing some aim in life, when the matter became settled in this way: Oh! I am to go through high school, then to college for a little while, then study law. And this at a time when lawyers were seeking situations at almost any salary, and lawyers' wives leaving them and going to the old home, because the husband could not provide bread and butter for two!

Too many of our boys are silently taught by the home influences to shun labor, and think a trade a disgrace, and their dainty sisters would not accept the attentions of a pushing young mechanic, because his purse is not deep enough to enable them to live in style. In such homes the idea of dignity in labor is flouted at.

Another suggestion:—In many shops there are men having families. If it were understood that, if a man should work in the firm's shops seven years his boys should have the trade of their father; if there were two or three boys in the family, then by putting one boy in the machine shop, another in the smith shop at engine or machine forging, we can secure boys who will serve out their apprenticeship and become expert workmen. There would be little danger of boys leaving and going to other shops because a little more wages was offered them—the ties of home and its influence would hold them.

Another point:—When a boy enters a shop as an apprentice, let an agreement be signed by his father or guardian, that the boy shall serve so many years as an apprentice, at such wages per year as may be agreed upon; that if he leaves before his apprenticeship is finished, and seeks employment in another shop, the owners or master mechanic of that shop shall be publicly notified that this boy has been unfaithful to his promises, and has not finished out his time, I am inclined to think a foreman or superintendent will give such a young man a wide berth. If this became customary in all shops, it would soon carry influence with it.

Another article in the agreement should be inserted that the father and mother of boys, taken as apprentices, must not expect to come to the office to complain of petty annoyances to their boy, on the part of either the men or fellow apprentices. We have seen in the past fifteen years boys spoiled by the foolish interference of a doting mother, and to-day they are common laborers, because they made themselves unbearable as apprentices, and could never learn anything decently.

We also suggest that in all shops where practicable, a room be opened for the boys to learn mechanical drawing during the winter months, and that some one give the boys their primary lessons. We think this would be a paying investment, and boys thus favored would become intelligent and clever workmen.

We served six years in a shop faithfully and well, and appreciated the kindness of our master mechanic, who often spent the evening with us over the drawing board. Some of us were away ahead of him in the higher branches of arithmetic and mathematics, and he knew it too, yet he was always willing to give us the instructions that lay in his power to give.

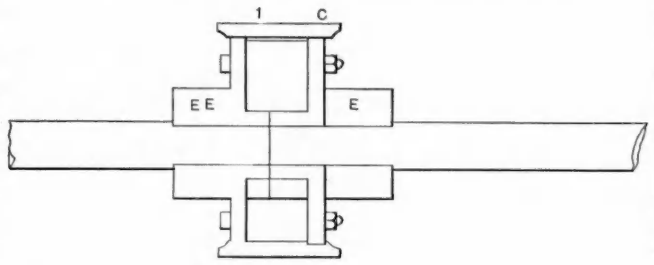
NORMAN.

Chicago, Ill.

The "Plank Check" Shaft Coupling.

Editor American Machinist:

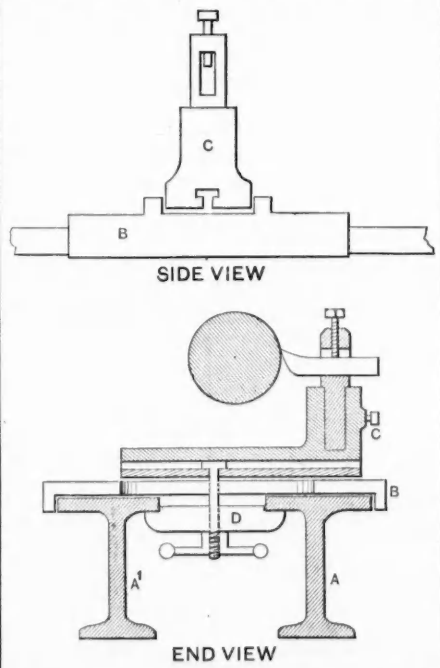
As there has been a great deal said in your paper about shaft couplings, allow me to say a word upon this important subject. There are good features about all the various kinds already mentioned. I desire to call attention, by means of the accompanying rough sketch, to a coupling that we have been using for some years past with very good satisfaction. Referring to the illustration, fig. 1 represents a cross section of the face of coupling having a casing to cover the coupling, bolts and nuts. It is a closed coupling. The coupling 1, is bored out for the reception of the steps upon the opposite half *E*, previously trued off at *C*, and bored to fit the shaft. Each of these pieces are turned and bored while in the chuck, to insure true work. The coupling is shown finished by fig. 2, while fig. 3, represents an inside section. The flange *B*, is turned to fit inside of fig. 2. The halves of coupling are shown keyed to the shaft in figs. 4 and 5.



It will be understood that there are wings or steps upon both parts of this coupling, which do the driving of the turned parts, causing it to run true. The face can be used as a pulley, if necessary. Keying them on the shaft does not throw them out to hurt anything. This makes an elastic connection, and does not tend to spring the shaft like flange couplings, which are not faced up after being keyed on the shaft.

PLANK CHECK.

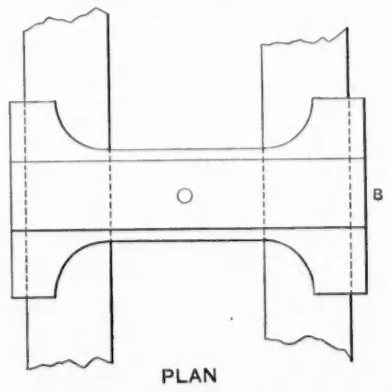
Glenwood Mills, Iowa.



Tools for Pattern Shops.

Editor American Machinist:

In your issue of February 19, 1881, Mr. Workman tells us how he intends to fit up his pattern shop for the accommodation of six pattern makers; and as that number will run up a heavy expense account, he concludes it will pay him well to invest some money in facilitating their work. He is not going to suffer for want of lathes, but the lathes will be likely to suffer if he makes a grindstone bed of them. If instead of a small grindstone to be used in the lathes, he will have a medium sized emery grinder set up alongside of his heavy grindstone, the grinder to have two wheels, coarse and fine, one being arranged to round and gum circular saws, he would then keep all the grit and sharp cutting dust away from his lathes and their tools. He would also have complete grinding machinery ready for use at all times. A lathe would not be required for that purpose, and therefore he could, perhaps, be enabled to dispense with one. Pattern work, whenever possible, should have the benefit of accurate working machinery, instead of hand work.



If Mr. Workman will have his lathes fitted with a light slide rest, as shown by the annexed cut, he can then trim and face straight work as true as an engine lathe; and if properly made, he will find them very quick and convenient for ordinary work. In the cut *A*, *A*, represents the lathe shears, *B*, the rest fitted on the ways to slide easily, *C*, the T rest and tool holder sliding across the lathe on *B*. By inserting a block between the clamp *D*, and the rest *B*, *C*, is held firm for turning rolls, etc., *B*, at the same time sliding by hand on the shears.

He will also find it very convenient to have his lathes fitted with a "Morse" or other good drill chuck, and in addition a supply of small twist drills. Then if a first-class wood turner is employed, it will be none the worse if he knows how to make patterns; but he should be hired for his excellence as a wood turner, and this man should, as far as possible, do all the turning, filling in his time with sawing, keeping saws and other tools in order. In this way Mr. Workman will have better patterns in less time than under the system he proposes. Another point will bear mentioning, viz., one saw table is not sufficient for six pattern makers. If he is determined to put in but four saws and lathes, he had better have three saw tables and one lathe, than three lathes and one saw. One of the tables should be fitted with a running table for cross cutting long stuff. A buzz planer is a good thing, but first and above all, he should have first-class saw tables, not clumsy wood frames and wood tops, but good iron top machines, arranged to raise and lower the saws, instead of the tops, in order to take in grooving heads, etc.

Why is it that so many wood-workers cling to wood tables for saws and shaping machines? I have known extension works fitted with the most expensive machinery, constructed especially for the work until they came to the saw table, and then any old rattle trap was made to answer. They seemed to think a better table might perhaps be easier for the operator, but would not quicken the work, but that idea is a mistaken one that frequently costs the price of a new table every year. An iron top stays true, wears a life time, and causes less friction with heavy work. This rule also holds good with the bed of a wood turning lathe. That small grindstone started me, and if Mr. Workman will put it in company with the big one, I will be satisfied. Just think of it. Three lathes worried by one small grindstone!

J. S. GRAHAM.

Rochester, N. Y.

One Cause of Defective Gear Casting.

Editor American Machinist:

In your issue of February 5th, my friend "Foundryman" of Toledo, O., writes an article on Hints to Foundrymen. I differ with him regarding the reason why a spur gear is defective in its cogs, also cannot agree to his remedy for the same.

I have made a large number of spur gears in the past twenty years (many of them as heavy as 3,000 lbs. each), and I never knew the iron to stop rising as long as a steady stream was kept running into the moulds, unless the bottom fell out, or some accident occurred to drain the mould. When the iron reaches the web on the arms, it will not rise quite as fast, for the reason that there is more space to fill, but it will continue to rise all the time until the mould is full, if there is no stoppage in the pouring process. My friend in his hints gives the following as a remedy: "Fill the mould quick with good sharp iron"—good advice, and worth following.

Where one man has good sharp iron to pour into a gear, and gets a bad casting, another has iron barely hot enough to run the casting, and gets one sound and without blemish. This shows that the remedy of my friend from Toledo, is no remedy at all,

and while the plan is a failure, it is reasonable to suppose that the actual cause of the defectiveness has not been ascertained. At some future day I will give a bit of my experience as to the cause of defective gears, with no disparagement to my Toledo friend.

John Snow.

Chittenango, N. Y.

Varnish for Patterns.

Editor American Machinist:

Your correspondent, "Sandpaper," says in regard to varnishing patterns, "No pattern maker who knows his business depends upon glue alone to hold his work together. He will give a liberal draft, whenever practicable, and be generous in the use of varnish, using yellow varnish (inferior workmen use black to hide imperfect workmanship)."

I understand the object to be attained by varnishing a pattern (or painting it) is to prevent its being affected by moisture, and to give it a smooth surface.

Coach painters and others, when work is required to possess the same qualities, first "fill" the pores of the wood with preparations which are rubbed in or absorbed by the wood, and thereby render the surface of the wood hard and smooth, before any paint or varnish is applied.

Many good pattern makers use lampblack and alcohol with a slight admixture of shellac varnish, to fill the wood of patterns in like manner, preferring to have the finishing coats of varnish also to contain lampblack.

Your correspondent may learn that many of the largest and best foundry establishments in the land black all their patterns, believing it to be the best method.

Either "Sandpaper" is teaching a fallacy, or I am mistaken in believing a pattern can be better finished with varnish which contains, than that which does not contain

Lampblack.

Bennington, Vt.

Why Don't Castings Shrink Vertically?

Editor American Machinist:

Will some of the gentlemen who furnish your columns with articles on foundry work, explain the well-known fact that castings have little or no shrinkage vertically?

Moulder.

Construction of Friction Clutches.

Editor American Machinist:

A correspondent asks, "What is the correct angle of a friction clutch?" Having had to use this device in several instances during the past few years, and having by trial found the angle that gives the best results, I offer the results for the benefit of your readers.

The object is to construct the clutch with the angle x, as acute as possible, without being liable to lock in its seat.

The more acute this angle, the less the effort required to lock the clutches, and prevent slipping during the transmission of power.

With an angle $x = 30°$, the clutch will always detach automatically the instant the lateral pressure ceases.

Any increase of this angle is unnecessary and objectionable.

With an angle $x = 25°$, the clutch requires a slight effort to detach it, and when once engaged will generally maintain its hold for a short time after the lateral pressure ceases.

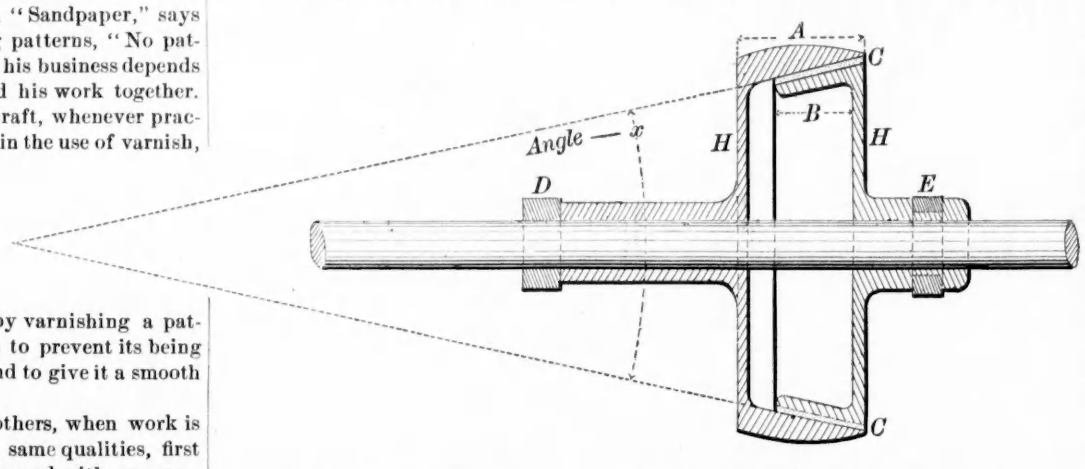
When the angle x is as acute as 20°, the clutch is liable to lock too rigidly for removal by hand.

For the majority of purposes where such clutches would be used, short transmissions requiring instant detachment, or sudden reversals, I would recommend the angle x to be made 28°.

The amount of power capable of being transmitted through such a clutch depends on the pressure applied to maintain the contact. For hand working with an ordinary lever, and without excessive pressures on the collars D or E, a transmission equal to 80 lbs. per inch of clutch face can always be effected, or fully as much, as can be transmitted through a single leather belt, one-half wider on face, acting on the external pulley A. In terms of the horse power, this would be

$$H\,P = \frac{V\,F}{600}$$

V = velocity in feet per minute at periphery of clutch; F = working face of clutch B.



It will be remembered, that these figures refer to a clutch, constructed as shown on sketch, one face being covered with leather c.

This is indeed the only proper way to make such clutches. If worked metal to metal they are apt to cut, especially if allowed to slip much, and the adhesion is much less than when leather-faced. The leather is easily applied to the inner clutch face, by cutting in suitable segments, and secured with small copper rivets. The faces will then endure well under the hardest service.

If the webs H, are cast solid, do not forget to drill a few small holes through them, to establish atmospheric equilibrium; otherwise, the caging of air inside will resist locking the clutch, or *vice versa*, resist its unlocking.

J. C.

Pencoyd, Pa.

Casting Pulleys and Fly Wheels Without a Pattern.

Editor American Machinist:

Large pulleys, fly wheels, etc., may be cast in green sand without a pattern, by the following plan, which has proven very satisfactory where used: It is a modification of the ordinary mode of sweeping up work in loam, dry sand, etc., being however more expeditious, as no drying is required. A plate B, Fig. 1, is leveled on the floor, having a movable upright shaft A, fitted to the hub upon it. An arm D, swinging at C, on an adjustable hub is fitted with a sweep E and F. A second plate (k) (or a continuation of plate B), is then leveled as shown, and a wall of brick-work N, laid in green sand is built on it as shown. Between these bricks, nails (m. m.) are built in to hold the green sand L. A cast iron ring with bars on it, may be substituted for the brick work and nails. Green sand is then thrown upon the outside face of the brick work, which is previously well wetted with clay-wash, and the sweep revolved to strike it off true. After striking off, the surface will necessitate slicking with the trowel to make a smooth surface after the brick work is up to a suitable height. The coves for the arms 5, 5, are laid in place as shown resting on the brick work and a bed of sand Q, or the hub 6 of plate B, being the section of one arm, and 7 the hub. The dotted lines P, show the gate and dotted lines; 4 the hub core, which is placed after the shaft A, is removed from the plate B. The shaft is then placed in a similar plate as B, and the outside face swept up as in Fig. 2, D, being sweep arm, E and F, sweep, V, outside flask, W, greensand, X, pin to left flask by U plate y,y,y,y, vent holes through

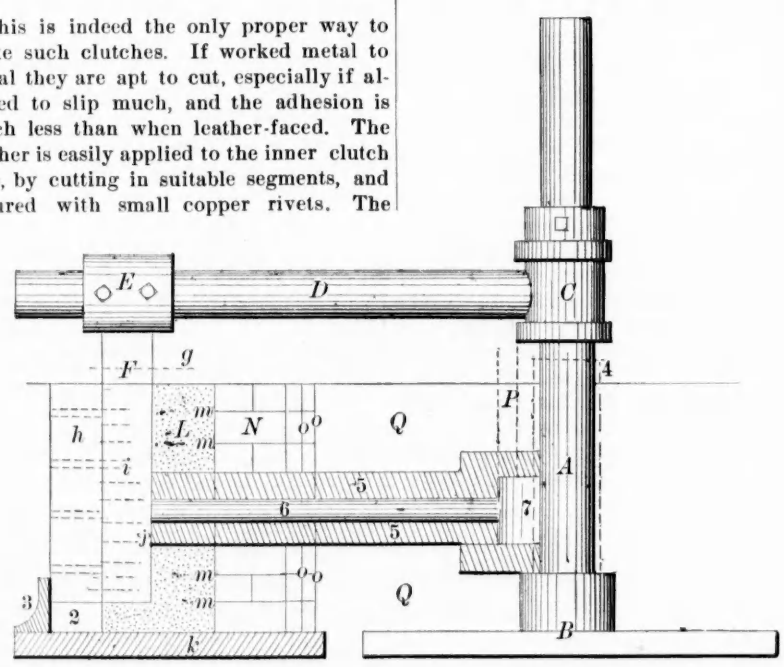


Fig. 1.

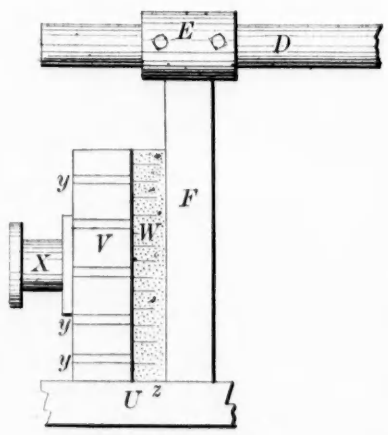


Fig. 2.

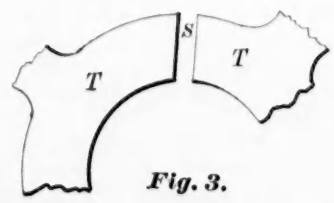


Fig. 3.

flask. When the outer face is swept and slicked, it is lifted by the crane, and the lower edge Z, eased off to prevent crushing, and allow a fin to run under it. The outer flask is lowered into place, resting on wooden blocks Z, which take the weight, and is guided to place by lug 3, etc. When in place, the dotted lines h, Fig. 1, represents the flask, i green sand and distance, j the thickness of the rim. A flat core g, may be laid on top as shown, or it may be left open, casting the upper half of rim wider than lower half, to allow the dirty portion to be cut off on the lathe. The spaces under and over the arm cores should be filled with green sand to keep the cores in place, and weighted with flat plates or boards on top of all. The wall of brick (if used for a ten-foot pulley) should be at least 18" thick, and the green sand in which they are laid should be vented and perpendicular vents o,o,o,o, run down to intersect them. The necessity of venting them may be done away with if a coarse gravel or similar open substance be used. A cast iron ring to take the place of the bricks is a better arrangement. It is a good plan in large pulleys to cut the hub with flat cores in the three places, as shown in Fig. 3, $T\,T$, being the hub, and S, the cut. This prevents any of the dangers of shrinkage. These openings may be afterward filled with zinc, and the hub banded on each side, and then bored and turned up.

Frank C. Smith.

Delaware, O.

Shrinkage of Pulleys in Casting.

Editor American Machinist:

I read an article in your paper of Feb. 26, entitled, "Pulleys with Equal and Unequal Arms," which carried me in imagination back to my boyhood days, when I read an article of identical purport, which concluded with the statement that it was impracticable to make straight-arm pulleys for general use, and that the only remedy was to use carved or crooked arms, which could not break in cooling. The "ancient" essay, as well as the article of your correspondent, was based upon the erroneous assumption that straight-arm pulleys *will* break by shrinkage; but the answer, in both cases, is, that many establishments now make straight-arm pulleys exclusively, without breakage.

A knowledge of the mechanical principle involved will, I think, assist your correspondent in remedying the trouble. It will be generally admitted that iron castings which break by shrinkage, break because the shrinkage is unequal, and the unequal shrinkage is caused by improper proportion of the pattern. This may be illustrated by a few familiar examples, viz., an ordinary pulley, say, 30 inches in diameter, 6-inch face, with hub suitable for 2-inch shaft, and having six straight arms, has one arm broken from the rim in cooling, because the rim and arms are lighter than the hub and cool first in the mould, and become rigid. The straight arms during the cooling process are thrust toward the center into the still soft metal of the heavier hub or boss, in which position they are firmly held by the hub. The further cooling and contraction of the hub continues to draw the arms towards the center until one or more are broken loose from the resisting and unyielding rim; or, if the arms are not broken, the rim is drawn in towards the center at every place where the arms join the rim. At the same time those parts of the rim between the arms are forced outward to a corresponding amount, and being in this condition, technically known as "strained," a slight rap or jar will cause it to break the arms loose from the rim, or the rim to break in two places and a piece to fly out.

There are several ways to obviate this difficulty: first, by reducing the weight of metal at the center of the pulley (including the arms) or increasing the weight of the rim, or both, so as to insure uniformity in cooling. Another remedy to prevent breakage is to open the mould at the center, by digging out the core as soon as possible after the metal is poured in, and then cooling the heavy parts by pouring water into the core hole, or the core may be made with pipes, into which water may be poured, to insure cooling the heavy part as fast as the rim cools. Another method to prevent breakage is to put "heaters" next the light parts of the pattern, to keep them hot as long as the heavy parts remain so. The first

remedy is the true one in most cases, but sometimes the others may be adopted.

Sometimes the rim of a wheel will be so heavy as to be the last part to cool; in which case, if the arms are straight, the rim will be broken and the crack drawn apart; in which case the same principle is applicable to remedy the defect, viz., increase the weight of the parts which cool first, or diminish the weight of the part which holds heat the longest, or take measures to maintain the uniformity of the cooling, by cooling the heavy parts or heating the light parts.

Keeping in view the principle that uniform cooling produces uniform shrinkage, it will be seen that the number of arms in a pulley is immaterial; but if faulty proportion of the parts produces a strain, the less the number of arms the less will be the liability of breakage, whether the number be odd or even. The reason is, the less the number of arms the greater the distance between the arms for the rim to yield to the strain. If a wheel had but one arm it would not break nor strain; but if a wheel having a light rim with arms entirely around the hub, *i. e.*, a disc, having a heavy hub, it will break every time.

The principle involved in making pulleys is equally applicable to making frames and all other parts of machinery, and the rule may be formulated thus: "Make the castings so that they will cool uniformly, and they will neither strain nor break."

OLIN SCOTT.

Bennington, Vt.

Why the Collins Coupling was Designed.

Editor American Machinist:

In looking over and reading the "Letters from Practical Men," I notice a cut of a shaft coupling called Fox's shaft coupling, which has one very serious objection, which is that the bolts—both the heads and nuts, project beyond the face of the castings.

I will give you the history of how I came to make the now so-called Collins' couplings. I had running in my shops the common flange or face couplings, held together by bolts. One of my men was placing a belt upon the pulley, near a coupling. While at work, he forgot the coupling with bolts, and one of the bolt heads caught his over shirt and jammed his head against the joist overhead, tore the shirt from his body and dropped him on the floor. He escaped with his life by having on an old shirt, which was not strong enough to hold his weight against the joist.

I then said I would make a coupling that would be free from bolts and nuts. I went to my office at once, and before leaving my table had made the drawings for the now so called Collins coupling, which I afterwards sold to Jones & Laughlins, of Pittsburgh, Pa.

W. B. DUNNING.

Geneva, N. Y.

Some Reasons for Poor Castings.

Editor American Machinist:

In preparing moulds there is, for different shapes and thicknesses, a wide range of methods of treatment. There is also a great difference in moulding sand; some kinds of sand will admit working quite damp, being very open, while there are kinds that have to be worked as dry as possible. Varieties containing much quicksand will draw off the cope while the mould is filling, if the casting be thick. In such sand every care has to be taken to prevent cope drawing, either by driving nails closely together, or by putting gaggers close down on the pattern and very near together when the cope is rammed, and to be rammed hard. Too much thought cannot be given to tempering sand, until you find just what it will do under every condition of moisture.

Very many castings are made that are not sound. They are dirty, yet they have not scabbed or blowed. As far as can be seen they lay as quiet and peacefully as those yesterday, when we got a shiner; but here is a dirty spot right where the casting will be finished. The cause of this may have been a piece of cinder run off from the lip of the ladle unperceived by the skimmer. It may have been that the core was not perfectly or sufficiently dry, thereby causing the metal to boil slightly when it reached the core. (If the metal is agitated during the filling of the mould, it will produce scoria or cinder in proportion to the disturbance.) The vent from the core may have got choked up. There may have been a few blows of the rammer given too near the pattern—not enough to produce a scab or scaling off of sand, but enough to prevent the metal lying peacefully. The iron may have been very dirty, and dirt may have arisen while pouring, or it may be the nature of the iron to oxidize rapidly.

These are all possibilities, and they occur daily in the history of every foundry.

Sand is oftentimes blamed for scabby work when it is not at all guilty. Castings in green sand that have cores set horizontally (of large size especially) should be thoroughly dried; for, if not dry when the liquid metal begins to surround it, the metal begins to dance and boil, gets thrown against the walls of the mould, falls back, and produces thin scabs. Then the moulding sand is bad—scabby; so judged by a jury composed of foreman, journeyman, melter, apprentice, one and all agreeing to the verdict, "that ere sand is a bad lot, not fit to make sash weights in."

Another core is made by the boy—who is good enough to make cores, but nothing else. All the lower shelves in the oven being full, he is compelled to put this core upon the top one. The core, by accident, gets what it needed first—a good drying; and the mould it is placed in produces a casting with no scabbing about it. But I am certain, when the same circumstances combine once more against the success of a casting, and it turns out a failure from the same cause, the jury will again convene and the former verdict will be confirmed against the sand. Get good sand, they will tell you, and you won't have any of this business. But a tablespoonful of brains and judgment combined, on that core bench, to make and dry the cores, will, in many instances, make bad moulding sand (so called) pretty fair, and pretty fair moulding sand first class.

There is a saying, that "it is a poor moulder who has no excuse for the shortcomings on his floor," and it is a fact that the poorest moulders have an excuse always ready of something happening, over which he has no control.

A moulder, who worked in a foundry out West, had been unsuccessful for some few days with his castings, and every morning would give the foreman some new reason why the piece was bad. One morning, as he was about to tell the reason why, the foreman says, "Let me tell it for you. The reason is, that it run out a little, scabbed a little, blowed a little, poured short a little, strained a little, and, if some loafer had not stepped upon it, it would have been a shiner."

FOUNDRYMAN.

Toledo, O.

More About Core Prints.

Editor American Machinist:

Those core prints appear to trouble my friend, the Foundryman, considerably, and notwithstanding his persistent inquiries, he seems to have failed in eliciting any satisfactory reasons why pattern-makers persist in making bottom core prints straight. If the subject is not already exhausted, I would like, with your kind permission, to ventilate the matter a little. Taper core prints on top and bottom of patterns, as advocated by A Foundryman are all right, both in theory and practice, *provided* a special core box is furnished with each pattern. But I have yet to discover the foundry where special core boxes are the rule and not the exception. In the majority of cases the core maker has to make one box answer for many jobs. I am speaking of straight round cores. My plan for straight perpendicular cores of 3″ diameter and less, where special box is not provided, is to make both *top* and bottom prints with just enough taper to draw easily without disturbing the mould. With such core prints the moulder is not obliged to file the bottom of the core, simply to point the top and place the core in position. When the mould is closed, the core fits the place it was intended to occupy. With taper prints, the moulder must file both ends of the core the whole length of the core prints. If he should stop at that, there might not be much harm done, but usually he files considerably beyond the length of print, and the consequence is the core has no bearings, and is often moved out of place by the flow of metal when casting. In my humble opinion there is no one system best under all circumstances. We have to modify our plans to suit particular cases. Often it is not necessary to have any top print at all, and sometimes we dispense with core prints, altogether supporting the cores by other means. Therefore, I cannot see why A Foundryman should insist upon an arbitrary system of taper core prints for all classes of cored work, any more than a pattern maker should insist upon having a moulder select the strongest parts of a pattern by which to draw it from the sand, instead of driving his spike into the joints, as he almost invariably does. I would like to hear the opinions of some of my brother pattern makers as to the best methods of making split pulley patterns.

SANDPAPER.

Brooklyn, E. D., N. Y.

An exhibition of registered models and patented articles will be held in Frankfort-on-the-Main, Germany, commencing May 1 and continuing to Oct. 1, the present year. A very large exhibition building is in course of erection, besides a number of smaller buildings. It will be a straight-out mechanical exhibition, under the auspices of the government, which has undertaken to place all patents and models in the exhibition that are in its archives. Machinery will be shown in operation, and quite a number of American mechanical articles will be placed in the fair by H. G. Moehring, of that city, who is largely interested in introducing the best American productions into Germany. We have just been favored with a call by F. L. Harris, who is collecting articles for Mr. Moehring's part of the exhibition, and who will have charge of the same during the fair.

Newly Incorporated Companies.

PENNSYLVANIA.

The Pittsburgh Rapid Transit Railroad Company, Pittsburgh. James Anderson, William E. Schmertz, and others, incorporators; capital, $720,000, in shares of $50 each. For the construction of a Rapid Transit Railroad in the cities of Pittsburgh and Allegheny. March 1st.

The Lincoln Manufacturing Company, Chester, Delaware County. Robert Wetherill, Richard Wetherill, and others, incorporators; capital, $75,000, in shares of $100 each. For manufacturing and selling yarns and textile fabrics made of cotton, wool, or other material. March 2d.

Pittsburgh East and West Railroad Company. Principal office, Allegheny. James Callery, W. C. Mobley, and others, incorporators; capital, $600,000, in shares of $50 each. For the construction of a railroad, 100 miles in length, from the city of Allegheny, in the county of Allegheny, to the borough of Clarion, in the County of Clarion. March 3d.

Pittsburgh, East Park, and Spring Garden Passenger Railway Company, Pittsburgh. Jos. S. Brown, Wm. W. Speer, and others, incorporators; capital, $75,000 in shares of $50 each. For the construction of a street railway in the cities of Pittsburgh and Allegheny. March 7th.

CONNECTICUT.

Electric Purifier Co., New Haven; A. D. Osborne, H. C. White and others, incorporators: Capital, $300,000; shares $100 each. To buy, manufacture, sell and lease Midling's purifiers, especially such as employ electricity. March 3.

NEW YORK.

The Highland Trans-Hudson Railroad Company; Lawson Valentine, Albert Crane and others incorporators; Capital $5,000,000, in shares of $100 each. To construct, maintain and operate a railroad, commencing at or near Pine Hill in town of Cornwall, Dutchess County, running thence to western bank of Hudson River at or near Storm King Mountain, thence across said river by means of a bridge to easterly bank thereof, and terminating at a point near Dutchess Junction. March 3d.

The Brooklyn, Fort Hamilton and Coney Island Railroad Company; Wm. Pitt Shearman, Edward Owen and others, incorporators; Capital $150,000, in shares of $100 each. To construct, maintain and operate a railroad, commencing in the town of New Utrecht, at or near junction of 3d avenue and Brooklyn City line, running southerly to Fort Hamilton, thence east through or near Bath, to a point on Coney Island, west of the Ocean Parkway in town of Gravesend. Length of road, about eight miles. March 9th.

The Crandall Type-Writer Manufacturing Company, Cortlandville; L. S. Crandall, John Hubbard and others, incorporators; Capital $100,000, in shares of $1 each. To manufacture and sell Type-Writing machines. March 3d.

Empire Steam Pump Manufacturing Company, Wilna, Jefferson County; Marcus P. Mason, Allen E. Kilby and others, incorporators; Capital $50,000, in shares of $100 each. For the manufacture and sale of steam pumps. March 5th.

The Electric Tube Company, New York; Thomas A. Edison, S. L. Griffin and others, incorporators; Capital, $25,000, in shares of $100 each. For the manufacture and sale of electric tubes, for conducting electricity. March 5.

Union Paper Box Company, of New York; Chas. H. Williams, Robt. W. Gilbert and others, incorporators; Capital, $300,000, in shares of $100 each. For the manufacture and sale of boxes, and the machinery for making boxes. March 5.

Albany Steam Planing Mill Company, Albany, William Park, John Bennett and others, incorporators; Capital, $100,000, in shares of $100 each. To plane and saw lumber and manufacture and sell blinds, sashes, doors, etc. March 7.

Chemical Composition of Steel Rails.

A metallurgical correspondent calls attention to some startling inaccuracies in our recent report of Dr. Dudley's conclusion as to the best chemical composition of steel rails. Misplaced decimal points, in the haste of going to press, did the mischief. The table of substances other than iron, should read as follows:

Phosphorus, not above	0.10 per cent.
Silicon, not above	0.04 "
Carbon, between 0.25 per cent. and 0.35 per cent., with an aim at	0.30 "
Manganese, between 0.30 per cent. and 0.40 per cent., with an aim at	0.35 "
Sulphur and copper	No specifications.

J. A. Fay & Co., Cincinnati, O., write us:

We mail you a brief account of the disaster which occurred to our works on Sunday morning last. This, while being very severe, is not so serious as it might have been, as we have saved our Corliss engine and boiler and a portion of our works, say, 150 x80 feet, four stories high, were not burned. We are doubling up our force, and have already started up this portion with 150 men and made arrangements to lease, temporarily, another building, which will be ample to employ as many more in addition. We shall run our tools probably all night, with a double gang of men (night and day), and so endeavor to make up the loss of time occasioned by the fire and loss of tools. Our shop was equipped with the most complete tools that money could buy, and, we believe, second to none.

We never were so pressed with orders, and we expect within ten days to be running our shops in full blast with a much increased force of men, and turning out our goods as fast as usual. We have been cheered and encouraged by telegrams and letters from every direction, expressing sympathy for us. We most sincerely appreciate this token of our many friends. We are not in the least disheartened, and in ten days from this date will have larger facilities than ever, and little delay will be experienced in filling their orders; to bear with us as well as they can a few days only. Works as large as ours, when overtaken by a calamity like this one which has come to us, take a little time to reorganize and get under way, but within 24 hours from time fire ceased we had 150 men at work, and we expect to pick up the burden and carry onward the same as if it never had happened.

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, MARCH 26, 1881.

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The printed date on each wrapper shows the time to which the subscription is paid. We discontinue the paper in all cases when the time paid for has expired, unless renewed.

Use of Dangerous Forces.

Some of the gas companies are circulating a little pamphlet bearing the title, "Water Gas. Is it a Dangerous Poison?" The question is answered in the affirmative, and evidence produced from items in quite a number of daily papers, where persons have been suffocated by inhaling water gas. If the manufacturers of water gas were to collect the same kind of evidence in regard to the fatal effects of inhaling coal gas, they might issue a book that would make timid householders tremble. The common item of news, "Blew out the gas when he went to bed, and was found dead in the morning, and the room full of gas," is familiar in almost every city. But if we were to dispense with illuminating gas, steam boilers, and every other agent of comfort and material progress that is dangerous when ignorantly managed, society would revert to the semi-barbarism of the middle ages. It is a much greater public benefit to disseminate intelligence of safe and proper methods of manipulating dangerous things, which have come to be recognized as necessities, than to spread distrust and alarm without any effort to cause safeguards where elements of danger exist.

Where safety can be assured, even if under ignorant management, it is desirable, but it would be very unwise to reduce everything to the level of ignorance, by assuming that destructive forces, which cause accidents when negligently handled, should be wholly discarded. It should be self-interest, as well as philanthropy, that prompts men whose business it is to supply objects and materials that become dangerous in ignorant hands, to disseminate as much knowledge as possible about their proper control. But these men do not always regard it so. Hardly a day passes without some distressing accident from the bursting of a boiler or the flying to pieces of an emery wheel; yet, instead of printing and sending out explicit instructions as to their correct management, the manufacturers of boilers and emery wheels, for the most part, are more zealous, each one in trying to convince the public that his productions are safer to use than those of other rival concerns. Users of dangerous forces, on the other hand, can not be excused from responsibility by reason of not being forewarned by those supplying the forces. It is a fundamental principle of government, that ignorance of the law excuses no one, and it is also very certain that ignorance of natural laws will not avail to exempt any one from the direct consequences of an infraction of a law of nature.

It is not often that useful articles that contain elements of danger can be superseded by others that are entirely devoid of danger. The electric light, for domestic purposes, is free from the dangers incurred by the use of gas, but its projectors have yet to prove their oft-repeated assertions that it is cheaper than gas—in fact, that it is even approximately as cheap as gas.

Real or Assumed Names in Correspondence.

As a general rule, those who have never written anything to appear printed in a periodical are somewhat reserved about having their names appended to the first article or communication when it does appear in print. This feeling often deters mechanics who possess valuable original ideas, which they have proved by putting into practice, from placing them upon paper, and sending the same to the American Machinist, where they would be read by and benefit thousands of other mechanics throughout the country. Not infrequently those who have written a great deal for printed pages shrink from having their names published, not wishing to be troubled to answer a multitude of individual inquiries that are sometimes prompted by an article on a mechanical subject. To all who are restrained from sending practical communications for these columns by any such reason, we would say that, while we require the name and address of every correspondent, it is a matter left entirely to the wish of the writer of any communication whether his real name shall be published or whether it shall be some fictitious name. It is the value of the matter contained in an article, and not the name appended to it, that insures its publication in these columns. One of our correspondents who occasionally writes under an assumed name, after referring to a recent criticism by another on the use of a *nom de plume*, writes as follows:

I am one of those who write occasional thoughts under a fictitious name, and have never for one moment thought that by so doing I was violating any rule of propriety or morals, nor that the attachment of my name and address would strengthen or add any force or authority to anything I have scribbled. My invariable practice is to get the pith out of, and to dissect the matter in the body of the article, and of judging of its worth thereby, and not by attaching any significance to the title of the individual no matter how important his standing or station in life, or in the scientific world, might be.

I believe I have good reasons why I should not attach my name to my articles; they are at least satisfactory ones to me, and I believe that Foundryman, Carbon, and others have good reasons why they do not put their proper names to their contributions, and I feel right glad that they do not, for it makes their articles more interesting to me than if signed with real names.

In conclusion, I would ask your practical letter writers to keep up their contributions, and to discuss in a friendly spirit the subjects that may from time arise in your columns through the medium of these letters, and not to pay any attention to who the writer is nor where he came from, or anything else of a personal nature. By doing this I feel sure that much good might be done, and we can be of great help to each other. Many practical men have good ideas, wrinkles or kinks which they would contribute for the good of their fellow workmen, but are deterred from so doing by being afraid of the sharp criticism of some one more gifted with the pen than they are, though not having the one-thousandth part of sound practical experience that they themselves possess.

Practical men who contribute to your paper do not do so with a feeling of bigness or smartness, neither are their articles intended for those who "know all about it," but are for the good of those young and old who do not know, and are desiring to learn, and for the inter-change of ideas among ourselves. These contributions are sent for just what they may be worth to each individual reader, and if only a few out of the many of your readers are benefited by their perusal, the aims of the writer are accomplished.

One great bugbear of many practical mechanics, who would like to put their ideas upon paper, is grammar. They are afraid their sentences will not be strung together so as to conform to the rules of syntax. To these we will say that, in order to use the English language correctly, it is not at all necessary to have committed to memory the rules of grammar. Let ideas be expressed in clear, straightforward language, without any reference to the rules for parsing, and nine times out of ten the composition will be more intelligible to the reader than the polished style of a grammar master. We learn to speak and write correctly by studying the style of those who habitually use correct language, not by the study of grammar. Some of our best contributors never studied grammar, and we are glad of it. Whenever it is practicable, a writer should be within reach of the big dictionary, but he ought not to look inside of a grammar.

New Adaptations of the Indicator.

The increasing attention which modern engineers are bestowing upon the steam engine indicator, together with the want of such an instrument in other departments of mechanics, would seem to suggest that a number of modifications or adaptations of this instrument would be in order for other purposes. It is well known that existing forms of the indicator will readily suffice to measure the pressure of steam, water, gas or air, in a manner satisfactory to engineers whose duty it is to advise purchasers regarding the relative value of engines. But there is no known form of the indicator that will indicate the performance of the engine builder who promises a customer that his engine shall be delivered within a certain time. The prospective behavior of the lathe, or planer or machine tool, which its manufacturer lauds to the skies as the best style of tool extant, would seem to afford another valuable opening for a modified form of the indicator. Were such an instrument in effective use, many an intending purchaser would be wise from foreknowledge, rather than from experience.

For the foreman or workman, who is desirous to assume the responsibilities of a new or advanced position, doubtless the best style of indicator known is that of actual trial. But the junior partner who, freed from the restraints of home, merrily sets out for a round of visits among the machinery manufacturers from whom he expects to make sundry and divers purchases, would seem to afford use for a less practical and more theoretical indicator than that last mentioned. An instrument that would promptly register all his movements on these occasions, for the information of his family or business associates, might reasonably be expected to prevent naughty behavior in many instances. Unlike the adiabatic curve known to steam engineers, the perfect curve in such cases would doubtless be the curve of transmission, as applied to the dissemination of correct information in the home circle.

Internal Pressure of Boilers.

In our issue of Jan. 29, 1881, we published the following question and answer, viz.: Where is the most pressure in a boiler, in the leg or drum? Fluids, when confined, as in a steam-boiler press, equally in all directions; consequently there is a uniform force exerted upon all parts of a boiler under a pressure of steam. We take this opportunity to remove an erroneous apprehension which exists in the minds of a great many engineers that there is a difference of pressure upon the internal surface of a boiler; moreover, we saw the following statement, published not long since: "The pressure at the bottom of the legs of a boiler is as much greater than that in the steam chamber as is due to the head of the water."

Natural philosophy informs us that, since the particles of a liquid move among each other with perfect freedom, it follows that *liquids must transmit pressure equally in every direction*. To illustrate: Let a close vessel be filled with a liquid which we suppose will have no weight. This is true of the water in a boiler under pressure. If an aperture be made in one side of this vessel and a tube inserted, in which is fitted a piston having an area of one square inch; then, if a pressure of one pound be exerted upon the piston, *each square inch, upon every side of the vessel, must sustain an equal pressure.* If a pipe, having a cap upon one end, be placed in a vertical position, and filled with water, a gauge applied to the bottom will indicate a pressure due to the head. But if a cap be placed upon the top and a pressure be applied, a gauge attached to the top will indicate the same pressure as the gauge at the bottom.

We believe a further explanation unnecessary.

How Sensible Girls Regard Young Mechanics.

One of our correspondents alludes, in another column, to the manner in which young women are accustomed to regard young mechanics. Now, there are good mechanics and poor mechanics, just as there are sensible girls and foolish girls. The boy who feels that he has an aptitude for mechanical pursuits, and is debating whether he shall become a mechanic or a clerk, should reflect that, in either case, girls who are not sensible are not worth grieving about. He should reflect that there are in this country to-day quite as many—probably more—mechanics, who, as proprietors and superintendents of manufacturing establishments, are able

to live in brown stone houses, if they feel like it, than there are merchants able to do so. He should reflect that the young man who pays proper attention to his personal appearance when off duty can, if he will, seem quite as neat and attractive to the eyes of sensible girls as the young clerk who sweeps out stores and opens boxes for his start in life. He should reflect that the young apprentice, in these days of cheap books and cheap papers, has every opportunity to read and study and to gather knowledge that will render his conversation bright and pleasing as the young clerk can hope to do. In a word, he should reflect that the same qualities which commend him, as an intelligent and ambitious young mechanic, to the notice of sensible girls, will infallibly commend him to the notice of the men who have influence in bestowing responsible positions, and want to recommend the right men for them.

The Pocket View of It.

Much has been written on the philanthropic aspects of the apprenticeship question, but as human nature is now constituted, the view which after all is likely to have the most influence, is the pocket view. Without the co-operation of employers little can be done; hence, anything that serves to call the attention of employers to the fact that apprentices may prove a good investment, may be useful.

A machinery manufacturer, who for obvious reasons withholds his name from publication, touches up this subject in this sensible, though money-making strain:

We were interested in your recent article on apprentices, and agree with you that no good shop can afford to do without them. We have four or five as smart boys in our shop as I ever saw, and would not exchange them for "machinists," so-called, who earn double what we are paying them. I am sorry that we have no regular system of agreement, but perhaps my plan works as well, for if we get a dull or vicious boy, we are not obliged to keep him; and it is by hiring a number of boys and keeping only the cream that I have succeeded in getting such good ones. I hire a boy at $2.50 or $3.00 per week, and tell him if he shows a desire to learn, and capacity, also, that I will push him along in his turn from one machine to another. If he does not, he must either leave or consent to see some smarter boy go ahead of him. I make it distinctly understood that promotion is in the line of merit, and not a question of seniority, so that every boy is on his metal, and "does his level best" all the time. You will appreciate the difference, and the probable effect on the boys. At the end of every six months I increase their wages also. One boy who has been with me a little over three years, and is about 19 years old, gets $2.00 per diem; another about the same age and who has served the same time, gets $1.75. They run down from this to $1.00, 75 cents, and 50 cents per day. I make it a point to encourage a boy's inventive genius, by telling him before hand what I want him to do, and asking him if he can think of a way to do it. I find that in a short time they will do almost any kind of a job without much instruction from a foreman.

Obviously what is lacking for general adoption in this plan is a written agreement which shall bind both sides. The boy should agree to remain a certain specified time, and to do his best, on pain of dismissal for neglect or incompetence. The employer should agree to pay wages on a certain graded basis, and to afford the boy fair opportunities to learn. A good plan might be to establish in advance, say, grades A, B and C in each year, on the plan used in our common schools. Class C would earn the minimum of wages called for by the agreement, while the hope of rising into classes B and A would spur the boys on, and the employer would profit by getting journeyman's work done at apprentice wages. Nor need there be any great amount of red tape about this matter of settling the degrees of proficiency that will entitle any given apprentice to enter any given class. The main thing is, to have some sort of fair understanding in advance, which will neither leave too much to the boy's wisdom and judgment, nor too much to the employer's conception of what is right and fair.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

NOTE.—Those who desire answers to questions must give their names and addresses or no notice will be taken of their communications. A great many anonymous letters are carefully deposited in our waste paper basket every day.

(1.) A. K., Albany, N. Y., asks: Please tell me the number of square inches of heating surface in a boiler tube or flue of 2″ diameter and 11 feet long. *A.*—To get the area of a tube multiply the circumference by the length in inches, and the product will be the area. In this case the tube is 2″, the circumference of which is 6.2832; then 6.2832 × 132″ = 829.3824″ area in square inches.

(2.) D. K. S., New York City, asks: Will you please inform me of the rule whereby I can obtain the circle of any desired diameter? For instance, I desire a circle of 100 feet diameter, or say 1000 feet in diameter. *A.*—You will find your question answered with diagrams in full in the AMERICAN MACHINIST for June 19, 1880.

(3.) E. K. K., Landsdale, Pa., asks: Would you please let me know what the wages of a good machinist is, working in a jobbing and repairing shop? *A.*—From $2.25 to $3.00 per day.

(4.) W. W. T., Pittsfield, Mass., asks: Which is the best place to enter the feed water in an upright 3 H. P. boiler, as low as possible on the water leg, or about even with the crown sheet? *A.*—We have obtained very satisfactory results by cutting a hole about on a level with the crown sheet and putting a piece of pipe within the boiler in an upright position. The bottom end of this pipe is screwed into an elbow and connects by means of any suitable joint with the feed pipe while the top end of the pipe (which is from 2 feet to three feet above the feed pipe depending upon the size of the boiler) is bent, so as to cause the water to flow from the opening in a circular direction around the boiler. By this plan the feed water is heated almost to the boiling point before it is allowed to mingle with the water in the boiler, thus preventing the cooling of the bottom of the shell which will cause leaks in time.

(5.) F. A. R., Newburg, N. Y., asks Will you please answer the following question? If a belt runs toward the high side of a pulley when the pulleys are on parallel shafts, why does it run toward the near end when the shafts are not parallel? I should think the same law would govern both cases and make the belt run to the tight side in either case. *A.*—You will readily understand the reason why the belt will not run as you anticipated by reading an article on The Running Conditions of Belts, by L. F. Lyne, in our issue of April 17, 1880.

(6.) W. M. B., Pittsburgh, Pa., asks: I have an engine 10″ x 18″, running at 70 revolutions per minute. A friend advises me to run the engine faster; which pulley should be changed to run the line shafting at the same speed? *A.*—It is generally advisable to change the size of the pulley upon the line shaft except in cases where the proportion of the fly-wheel will not do for a higher speed. You do not state how much faster you wish to run the engine, neither do you give the size of fly-wheel, therefore we cannot be more definite.

(7) F. G., Brantford, Ont., asks: Will you or some of your readers inform me if it is possible to cut a thread in an ordinary lathe and have the tool cut both ways by simply reversing the lead Screw? That is, the work upon which the thread is to be cut will always rotate in the same direction; and the tool by means of the lead screw is made to move in one direction, and by reversing the lead screw it is made to move in the opposite direction? Now if we allow the tool to cut while moving in either direction will it produce a right hand thread? I contend that such a process will cut a right and left hand thread, and my friend says it will not, and that he has acomplished the feat on different occasions. Not being where we could prove the question in a lathe we await your decision. *A.*—You are right; but giving your friend the benefit of dis. playing his genius please advise him to try the experiment in your presence, and send us the specimen, telling how it is done, for publication. He will probably be like some of the electric light people who *refuse to make the test except privately and then insist upon doing it all themselves.*

(8) J. M. C., Scammonville, Kan., asks: 1. How is a skin of brass put on a steel or iron journal? (It is sometimes done by engineers to increase the size of a journal which has become worn). Please give the process. *A.*—The journal or rod is first turned parallel. A brass sleeve or bushing is then bored slightly smaller than the shaft, after which it is heated sufficiently to allow it to slip over the shaft, then quenched with water. This process is used for covering iron and steel rods with brass varying in diameter from valve stems of 1″ diameter up to propeller shafts of 20″ diameter. In the latter case the brass covering is in sections to facilitate fitting up. 2. How can the bright work of an engine (the steel and iron) be best protected—that it may remain bright, without being so frequently rubbed or scoured with emery, or other substances? *A.*—Wipe with perfectly clean rags or waste and rub over with fine sperm oil. Or if the parts are not liable to be disturbed a coating of very thin shellac will do very well. The shellac must be carefully applied, the parts being previously well cleaned with alcohol.

(9.) T. M., Cleveland, O., writes: I want to carry power to a building across a 60-foot street: the line shafts in both buildings, are at right angles with street, I would be prevented by city ordinance from using other than an underground connection, and would get water at a depth of three feet; be kind enough to suggest a plan. *A.*—Put down a water-tight iron box, to form a pit for pulley, in each building, and run a line shaft across the street, sufficiently below the surface of the ground to avoid being disturbed. In some cases it has been found the most economical to run a well-jacketed steam pipe to an engine located a long distance from the boiler. Such instances are quite common in this city.

(10.) T. B. R., Philadelphia, Penn., writes: I am about to put up a line shaft 158 feet long; would I lose much power by driving it from one end, instead of making the attachment in center? *A.*—The loss of power is not the greatest objection to driving a long line shaft from the end. In driving heavy or very fast running machinery, a long shaft will spring considerably, thus causing a very unsteady motion. The loss of power will be proportional to the length and diameter of the shaft and the load.

(11.) Salem, Mass., asks: Will you be kind enough to tell me the best way to prepare leather used for the piston of a water motor? I have been using the following mixture: Two parts tallow, one part beeswax, and one part spermaceti; leather dropped into the mixture when quite hot. I wish the leather cured so that no water can penetrate it. The water will be of no warmer temperature than that supplied by the aqueduct. Give me a better preparation than the above if you have one, and how to use it. *A.*—We recommend the use of castor oil for the purpose named by you, although the preparation you have used is good. But you should not apply the mixture hot, as the heat will destroy the life of the leather. It should not be applied at a temperature higher than blood heat.

(12.) J. B., New York, writes: I had an argument in the shop on belting. Which is the proper side to run on face of pulley, the grained or flesh side, for speed and power; also, what is best to grease a tight belt with if it slips? *A.*—It has been demonstrated by practical tests that a belt with the grain side placed next the pulley will transmit about 34 per cent. more power than when the flesh side is next the pulley. We find castor oil is an excellent grease for belts, but it should not be used in excess.

BUSINESS SPECIALS.

50 cts. a line for each insertion under this head.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. American Machinist Publishing Co., 96 Fulton St., New York.

Alfred Wilkinson, Expert Engineer, S. W. corner Second and Girard avenue and 1114 Beach St. P. O. address, Manayunk, Phila., Pa. Indications of Steam Engines a specialty.

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Vertical and Horizontal Pumps. Capacity from 100 to 35,000 galls. per minute. Simple, Efficient, Economical, Durable. Used by more than half the tanners and paper makers of the country. Horizontal and Vertical ENGINES, from 10 to 30 H. P., for long continued hard work. Prices, 40 per cent. below other makers. Send for circulars. Heald & Morris, formerly Heald, Sisco & Co., Baldwinsville, N. Y.

James W. See, Designing and Consulting Engineer, Hamilton, Ohio.

"Extracts from Chordal's Letters" in book form, now ready. Cloth. 320 pages. $1.50 by mail, postpaid. American Machinist Publishing Co., 96 Fulton Street. New York.

J. C. Hoadley, Engineer and Expert, formerly of Lawrence, Mass., has opened an office at 29 High St., cor. Federal, Boston, Mass., where he will be pleased to receive old and new friends.

Steam Engines Indicated and Examined. Power Measured. W. H. Odell, P. O. Box 274, Yonkers, N.Y.

Bound volumes for 1880 of the AMERICAN MACHINIST.—We can furnish Vol. 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, neatly bound in cloth, ready to ship by express, for four dollars. AMERICAN MACHINIST PUBLISHING CO. 96 Fulton Street, New York.

Wood Engravings of Machinery and Tools. Satisfaction guaranteed. Chas. Murray, 58 Ann St., N.Y.

Wanted to arrange with responsible parties for the manufacture of a New Air Compressor. The best yet designed. John Fish, 8 Pine Street, New York.

MANUFACTURES.

The Hancock Inspirator Company, Boston, Mass., are now employing 100 men, and are crowded with orders for pop valves, inspirators, and other jet apparatus.

The Hamilton (Ont.) Bridge and Tool Company are applying for a charter of incorporation; capital to be $70,000.

One of the several special tools that W. H. Warren, Worcester, Mass., is making for the Hartford Engineering Co., Hartford, Conn., is a shaper designed expressly for planing brass, cutting one hundred feet per minute.

The large wood-working machinery establishment of J. A. Fay & Co., Cincinnati, O., was damaged to the extent of $125,000 by fire on the 7th of the present month. The concern is an incorporated company with $225,000 capital; W. H. Doane is president, and D. L. Lyon secretary. There are thirteen stockholders, all employed in the establishment. About 250 men are employed, and it was the intention to build an addition this spring to enable them to supply their increasing orders for machinery from all parts of the world. The insurance amounts to $87,500. It is as yet uncertain whether they will rebuild on the site heretofore occupied or move outside the city. An offer was recently made of six acres of ground and $30,000 cash to move outside the city. That offer will be considered by the directors at their next meeting. Work has been resumed in that part of the building which was not destroyed and it is proposed to run night and day to fill orders.

The Alton Water Works, Alton, Ill., opposite St. Louis, are setting two boilers with the Jarvis Furnace.

Something like a year ago, the manufacturing establishment of Herrman, Aukum & Co., situated in Troy, N. Y., was destroyed by fire. The firm were extensively engaged in the manufacture of ladies' furnishing goods. Since then, Mr. Aukum has purchased quite an extensive tract of land adjoining the city, and in addition to the necessary buildings for manufacturing purposes, has erected several neat and commodious dwellings. He proposes to erect more dwellings, his purpose being the establishment of a community; hoping in this way to arrange matters to the mutual benefit of all parties—bringing about a community of interests as well as a community in name. Mr. Aukum has just ordered a 25 horse-power "Hemenway automatic engine" from the Messrs. Starbuck Bros., to replace the one at present in use.

The Vermont Copper Mining Company, Ely, Vt., have put in three steel boilers built by D. M. Dillon, Fitchburg, Mass. They have been set with the Jarvis Furnace.

One of the stockholders in the proposed beet root sugar factory at Schenectady, N. Y., is reported as stating that $125,000 of the necessary $150,000 has been secured and the balance will be subscribed this week. The company will begin building immediately and will order its machinery by cable.—*Boston Commercial Bulletin.*

A brick manufactory 50x100 feet and five stories high, will be built in Cohoes, N. Y., by Benjamin F. Clark and P. S. Holsapple.

D. A. Wilkins is purchasing machinery for a new cotton factory at Duck Hill, Miss., which will soon be put in operation.

Norfolk, Va., is receiving machinery for a new cotton factory.

Knoxville, Tenn., is to have an agricultural implement manufactory.

A rope factory is to be put in operation at Rome, Ga., in less than ninety days, says the *Chattanooga Tradesman.*

The Winnipiseogee Paper Co., Franklin, N. H., have just put in a new steel boiler, built by Whittier Machine Co. of Boston. This will be set with the Jarvis Furnace, making eight boilers they have set this way.

The Hartford Engineering Company, Hartford, Conn., write us:

We notice in your last issue an extract from the *British Trade Journal*, containing the statement that although pulleys, with wrought iron rims and having arms, have been made, but have not been successful, owing to their running out of true. Now we don't know anything about the English pulleys, or why they run out of true. But we *do* know that the wrought rim pulleys made by us run *absolutely* true at any speed, and with no tendency to throw oval at high speeds, due to the counter-balancing weight or uneven thicknesses.

Machinists' and Engineers' Supplies.

Trade is good and increases in volume. C. W. Le Count, South Norwalk, Conn., is about to bring out a "straight-tail dog." He is convinced that when the peculiar merits of this variety of dog are well understood in machine shops it will be extensively used. A new breed of malleable iron die dogs is just being introduced by J. W. Hamer, 140 Centre Street, New York. He has six sizes, ranging from ½ to 2 inches, and selling from 40 cents, to $1.10, with a disconnt of 30 per cent. The Ashland Emery Company, Perth Amboy, N. J., issue a circular, in which they say: "Considerable supplies of emery have reached this market since the beginning of the year. Selected ore is not in over supply. In the market for manufactured emery there has been a good demand, and, if anything, prices tend slightly upward. Our quotations remain unaltered."

Edward Wright & Co., Worcester, Mass., offer their patent Calipers at the following prices: 3 in., $1; 5 in., $1.25; 7 in., $1.50. The Tanite Company, Stroudsburg, Pa., are about to offer several new emery-grinding machines. Stover Manufacturing Company, Freeport, Ill., are about introducing a new work-holder for drill presses which holds all forms of work—circular, irregular and right-angled.

Iron and Metal Review.

New York, March 9, 1881.

Pig iron is dull as ever. American pig is selling as follows: No. 1 $25 to $26; No, 2, $22 to $23; Gray Forge $20 to $21; Scotch Pig sells in small lots at $24 50 for Coltness and $22 to $22.50 for Eglinton. Bar iron from store is steady on a basis of 2.5c. for refined. No. 1 Wrought Scrap sells at $30 to $31 from yard. Old T rails are quoted nominally $27.50 to $28; Ingot Copper is steady at 19¼c. to 19⅜c. for lake and 18¾c. for Baltimore. Tin is firm at 19¾c. to 20c. for Straits, Australian and Billiton with common English a shade higher. Pig lead sells at 5c. to 5⅛c. for refined and 4⅞c. for common. Spelter is dull at 5c. for Domestic and somewhat firm at 5¼c. for Silesian. Sheet Zinc, 7c.; Antimony, 14¼c. to 14½c.

WANTED

Wanted.—A mechanical draftsman with practical machine shop experience who is familiar with Stationary Engine and Mining Machinery drawing. Address Webster, Camp & Lane Machine Co., Akron, O.

Contracts wanted to make some light machinery or patented article of metal. Estimates furnished from model or drawing. Address Philada., Box 3, American Machinist office.

Wanted, Foreman for Machine Shop. Thorough mechanic competent to manage men. Satisfactory references required. Address B. W. Payne & Sons, Corning, N. Y.

Wanted.—By a graduate of the Scientific School at an eastern college, who has had practical experience in machine design, a situation as draughtsman and designer. Good references. Address, Draughtsman, P. O. Drawer 38, New Haven, Conn.

Wanted.—Foreman for machine shop employing 60 men. He must be energetic and thorough. Nordyke & Marmon Co., Indianapolis, Ind., Builders of Flour Mill machinery.

Wanted.—A Foreman Moulder for foundry, where large castings for steam engines, etc., are made. Apply by letter to "109," office American Machinist.

Wanted.—A good turning lathe of 50 or 60 inches swing and 5 or 6 ft. between the centers. New or second hand. Address E. S. Swain, 1536 Master St., Philadelphia, Pa.

CHAS. G. LUNDELL,
No. 7 Exchange Place,
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REPRESENTING
SWEDISH IRON
EKMAN & CO.
GOTHENBURG,
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THE LARGEST
MACHINERY DEPOT
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HEADQUARTERS FOR
MACHINISTS TOOLS.
Boilers. Engines and Pumps. Machinists Tools. Mining Machinery. Woodworking Machinery. Turbine Wheels. Emery Wheels. Blowers Supplies. Etc.
STANDARD GOODS AT BOTTOM PRICES
H.B.SMITH MACHINE CO
925 MARKET ST.
ESTABLISHED 1849. PHILA. PA. U.S.A.

WANTED.
Three or four first-class Boiler Makers. Wages $2.25 to $2.50. B. W. Payne & Sons, Corning, Steuben Co., N. Y.

WANTED.
Terms and Specifications for Concentrating Machinery for the reduction of Antimony Ore. Address, with full particulars,
Lake George Antimony, Mining and Smelting Co.
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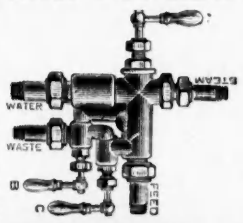
64 EQUITABLE BUILDING, BOSTON.

THE DUPLEX INJECTOR.



The best Boiler Feeder known. Not liable to get out of order. Will lift water 25 feet. Always delivers water *hot* to the boiler. Will start when it is hot. Will feed water through a heater. Manufactured and for sale by
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Office, No. 78 Chambers Street, N. Y. | Full Weight Hand-Cut Files. | Manufactory, PATERSON, N. J.

The best and cheapest in the end. Send for quotations. The files speak for themselves in the following testimonials. Read them.

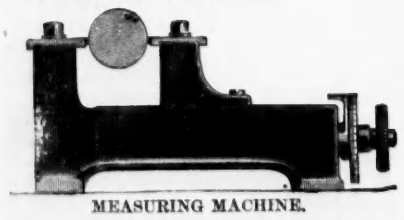
THE SINGER MANUFACTURING CO.
Messrs. Kearney & Foot, Elizabethport, N. J., July 9th, 1877.
Dear Sirs:—We have for the past ten years used the Files of your manufacture, and during that time we have never had any fault to find with them. We can safely affirm that for evenness of temper, sharpness of cut, accuracy of shape and all other qualities which go to make up a perfect File, they are equal, and in some respects superior, to the best English-made Files. Very Truly, Wm. H. INSLEE, Contractor.
Messrs. Kearney & Foot, Elizabethport, N. J., May 3rd, 1877.
Gentlemen:—We have been using your Files, both new and re-cut, for several years, and take pleasure in saying that we have found them a very superior article.
HANS REISE, Contractor, with The Singer M'f'g Co.

We print on card board 10 x 12 in. "Instructions on the use of Files," which are intended for shop use. These instructions with our "Illustrated Catalogue of Files" we mail on receipt of 27 cents postage. To customers we mail a complete set free of charge. KEARNEY & FOOT.

BETTS MACHINE CO., Wilmington, Del.
MANUFACTURERS OF
STANDARD GAUGES,
Measuring Machines & Adjustable Reamers.

STANDARD GAUGE.
Any size from ¼ in to 6 in.

CORRECTIVE GAUGE.
The disks are ground separately. Any combination of sizes can be made.

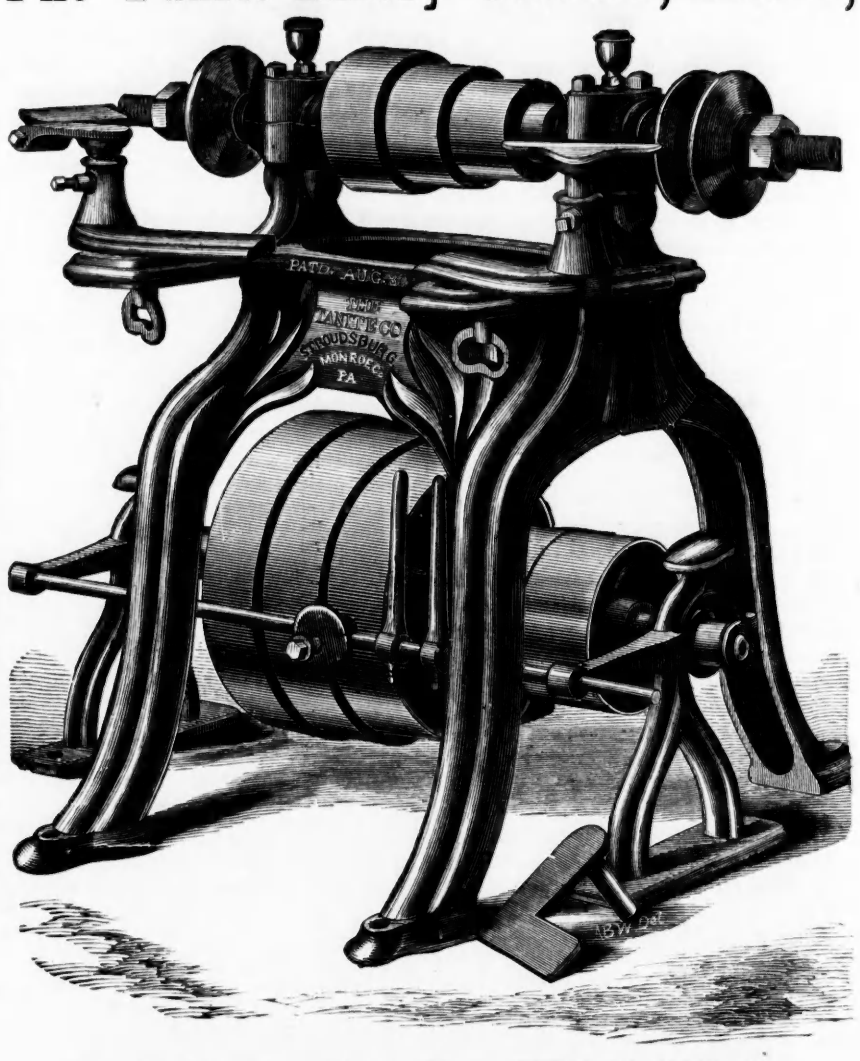


MEASURING MACHINE.
Sizes, 0 to 4 in., 0 to 12 in., 0 to 24 in. Can indicate to $\frac{1}{10000}$ of an inch.

ADJUSTABLE REAMER.
Any size from ½ in. to 2½ in.
Size Maintained by Blade Adjustment.
Will Outlast the Solid Reamer.
Shank Ground to Standard Size.

KEEP SIZES RIGHT and thus CHEAPEN PRODUCTION.
SEND FOR CIRCULAR.

The Tanite Emery Grinder, No. 3,



TO RUN WHEELS FROM 12 TO 24 INCHES IN DIAMETER.

This machine is of the same pattern as Nos. 1 and 2, but has legs of such length that it may stand upon the floor. It has a Steel Arbor which is 1⅞ inches diameter in the bearings, and turned at ends to 1½ inches. The Flanges are 6 inches in diameter. It has Cone Pulleys so as to give three rates of speed. Each machine is provided with one Face and two Side or Surface Rests. The Overhead Work consists of Counter Shaft, pair of Adjustable Hangers, Tight and Loose Pulleys of 8 inches diameter, and Belt Shifter. For full list of THE TANITE COMPANY'S widely distributed depots, consult the advertisement on last page of this paper.

DRILL WORK HOLDER.

Adapted to all forms of work. Saves labor and breaking of Drills. Recognized by experienced machinists to be the most practical tool for the purpose ever invented.
STOVER MFG. CO., Freeport, Ills.

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The Waters Perfect Governor,
Having Adjustable Speed, Automatic Safety Stop, Sawyer's Lever, and Solid Composition Valves and Seats.

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Spring Calipers,
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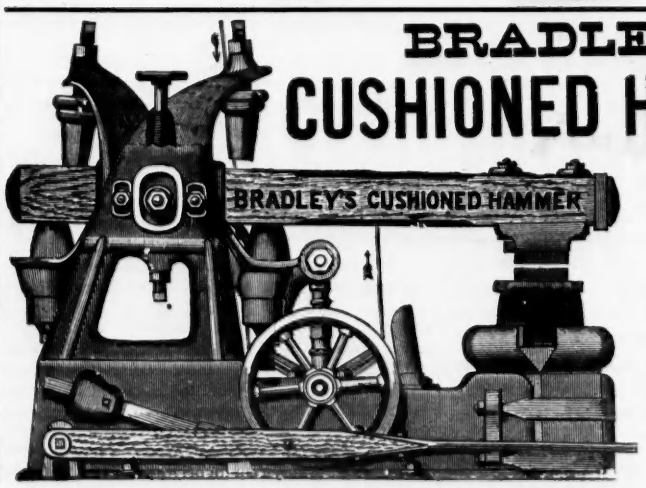

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WITHOUT AN EQUAL.

It approaches nearer the action of the smith's arm than any hammer in the world.

Bradley & Company,
SYRACUSE, N. Y
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